THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. XXIII.—No. 562

TELEGRAPHIC COMMUNICATION WITH LIGHTHOUSES.

AN important step towards that systematic telegraphic communication between the mainland and our lighthouses which has so long been pressed for on behalf of the commercial marine has been effected by a Bill which received the Royal Assent just before the adjournment of Parliament, viz., Lloyds's Signal Station Bill. This measure, having been passed by Select Committees of both Houses, was finally disposed of in the House of Commons two days before the adjournment, after a brief but useful discussion, as will appear after we have described the provisions of the Bill. It was really the outcome of a Departmental Committee, who recommended, among other things, that outlying islands and lighthouses should be placed in electrical communication with the mainland, with a view to preventing loss of life at sea. For the purpose of establishing the requisite signal stations on shore, it was necessary to obtain land, and this Lloyds had found great difficulty in doing. This Act at the outset empowers Lloyds to "execute the following works and do the following things," viz.:—To "(1) Establish signal stations, and erect and place signal houses with all requisite works, roads, appurtenances and appliances at such places on the coast of the British Islands, or any islands, shoals, or rocks lying near thereto, as they think fit, and maintain and work the same with a proper staff of keepers, officers and servants, and from time to time alter or remove any such signal houses or discontinue any such signal stations. (2) For the purpose of connecting any of the said signal stations or signal houses with each other or with postal telegraph stations, enter into arrangements with the Postmaster-General for the placing, maintaining, and working of wires for the purpose of telegraphic or telephonic communication by him upon such terms and conditions as he shall prescribe: and (3) Acquire by compulsion or agreement and hold any lands which may from time to time be necessary for any of the above purposes or for the purpose of providing residences and suitable gardens for signalmen and signal-house keepers. Provided that the extent of land to be acquired by compulsion under this Act at any one place shall not exceed two acres exclusive of the necessary means of approach; but nothing in this Act shall empower the society to take any part of a railway or canal." The next clause provides for the application of the Lands Clauses Acts, for notices to be given to owners of land, and for other customary formalities; and subsequent provisos safeguarded against interference the rights and lands of the Admiralty and War Office, the lands, apparatus, &c., of the Post Office, the privileges of the Postmaster-General, and the lands of Government Departments generally. Then come Clauses 9 and 10, which enact respectively, "That nothing in this Act shall authorise the society to acquire otherwise than by agreement any property belonging to a lighthouse authority or any rights or powers over the same," and that "(1) The society shall not erect or establish any signal house, or other erection, or execute any work of any kind, which in the opinion of the general lighthouse authority for that part of the United Kingdom in which the signal house, erection, or work is proposed to be built or executed, will obstruct the light or sound from, or in any other manner interfere with or impair the usefulness or efficiency of any lighthouse, light vessel, beacon, buoy, fog signal, or other sea mark under the jurisdiction of that authority. (2) If any such signal house, erection, or work is commenced or completed in contravention of this section, the general lighthouse authority may at any time abate and remove the same, and restore the site thereof to its former condition, at the cost and charge of the society, and may for that purpose enter on any lands of the society, and do thereon all such things as may be necessary for the said abatement, removal, and restoration. (3) The amount of the costs and charges incurred in any such abatement, removal, or restoration, shall be a debt due from the society to the general lighthouse authority, and shall be recoverable accordingly, with costs. By the next clause (11) Lloyds are forbidden to construct or, when constructed, work in or under or otherwise interfere with the bed or any other part of the Thames except according to plans to be approved by the Conservancy; and clause 12 declares that the society shall not construct on the shore of the sea, or of any creek, bay, arm of the sea, or navigable river communicating therewith, where and so far up the same as the tide flows and reflows, any work without the previous consent of the Board of Trade, and then only according to such plan and under such restrictions and regulations as the Board of Trade may approve of, and that where any such work may have been constructed, the society shall not at any time alter or extend the same without obtaining previously to making any such alteration or extension the like consents or approvals.

The next five clauses refer to "future accretions," and with the rights of the Duchy of Cornwall, and the foreshore rights of the Crown, and, finally, clause 18 enacts that "Nothing in this Act shall authorise any interference with any works or any undertakers within the meaning of the Electric Lighting Act, 1882, to which the provisions of that Act apply."

The Bill was practically passed as originally drafted, but when it came finally before the House of Commons (which dealt with it after the House of Lords) Sir Wm. Barttelot objected to it as conferring too much power upon a private company. Thereupon Sir. M. H. Beach gave a useful explanation of the measure, in terms less technical than those of the Bill. Sir Wm. Barttelot, he said, was mistaken in supposing that the Bill proposed to give to Lloyds the wide powers which he imagined. There was a general feeling among those interested in

the commercial marine and among those who desired better facilities than at present existed for giving early intelligence of wrecks occurring on our coasts, and thus saving life and property, that better means of communication should exist between our lighthouses and light ships and the mainland. Lloyds Association, which was an association not trading for gain but a public association, communicated with the Board of Trade on the subject last year and expressed their willingness to take an active part in providing this means of telegraphic communication if certain powers were given to them subject to certain restrictions. The powers amounted to this: Power was given to acquire land on the coast near those lighthouses or lightships not exceeding two acres in any one case for the purpose of providing this telegraphic communication between the lighthouses and the lightships and the mainland. That power was granted by the clauses of the Land Consolidation Act, under which any landowners could, of course, have compensation assessed by arbitrators in the regular way. No land could be compulsorily taken until after the matter had been fully considered by the Board of Trade, after inquiry had been held, and after a provisional order had been made and confirmed by the House. He thought the House would see that every care had been taken to guard private rights in endeavouring to secure what would be admitted to be a great public gain.

Admiral Field complaind that the interests of the country, so far as the navy was concerned, had not been thought of in the Bill, and he urged that the Postmaster-General should be empowered to obtain possession of all the stations in the event of war, to prevent useful information being sent to the enemy. Sir M. H. Beach pointed out that clause 2 provided for such a contingency. Sir William Barttelot again objected, insisting that these stations ought to be in the hands of the Government, and not of Lloyds; but the majority of members strongly supported the Bill as urgently needed for the saving of human life, and the prevention of shipwrecks, and finally the Bill was passed in the form indicated above.

THE tone of Dr. Andrew Wilson's letters in our recent issues would lead one to believe that he was the inveterate enemy of the sham electro-medical firms with which the metropolis is now well supplied. Yet, if this be the case, it is difficult to understand that a man who cares one jot for his reputation as a professional man and an editor should have countenanced the admission of such an article into his journal, *Health*, of the 17th inst. as that extracted from *John Bull*. It is these reproductions from papers which, in technical matters, are not expected to be able to sift the grain from the chaff, that do so much towards furthering the schemes of these firms. If *John Bull* either wittingly or inadvertently chooses to disseminate such literature as that to be found on p. 309 of *Health*, surely it is the bounden duty of an editor to see that it stops short of those columns which are supposed to deprecate any kind of quackery. It is much to be regretted that a gentleman holding the position of Dr. Andrew Wilson should lead one to suppose that he is capable of blowing hot and cold with the same breath. Perhaps, however, a full page advertisement, which we notice, is not altogether unconnected with the reprint of which we complain.

"HEALTH" generally implies that one's circulation is good. We see, however, in an "important announcement" in the same number as that to which we refer above, that inducements are offered in the shape of presents of books, written by Dr. Wilson, to persons to subscribe yearly for that journal.

SINCE writing the above we have had sent to us from several sources copies of a letter and an "editorial enclosure," which emanate from the Medical Battery Company. The latter, which *John Bull* and afterwards *Health* published *in extenso*, bears the following request: "Mr. C. B. Harness will esteem it a favour if you will kindly insert this editorial in your next issue." Then follows the inspired article, of which we have already complained. The letter repeats the request, but at somewhat greater length, and ends by inviting those journalists who care to insert it to trot round and inspect the "electropathic" establishment. What a commentary upon the *freedom* of the press!

WE are promised by a contemporary the most instructive and exhaustive series of articles on the magnetic field ever published. The first article of the series appeared last week and as regards ourselves was fairly exhaustive. Our friends who read the journal in question will have no difficulty in reading between the lines of his ponderous sentences the name of the writer, who fairly revels in mechanical models and sticks up analogies on every opportunity to knock them down again like skittles. First a uniform magnetic field is likened to threads stretched between two points, or one might compare lines of force to fiddle strings if it didn't sound too funny for practical use. But this analogy breaks down, and the next conception is that of magnetic wind. We only hope the talented author will not reap the magnetic whirlwind. But wind is found to be too slow and nothing less than gunpowder continuously exploded at the pole of the magnet will serve to convey the idea of lines of force emanating from it. Our author intends this analogy to *fix* the ideas, but as it is a dynamical representation we prefer, in view of the fact that they are at the mercy of gunpowder, to consider them as *conveyed*. The gases created by the explosion of this gunpowder are not subject to mere mundane laws. Indeed, the magnet having been bored out for a continuous supply of powder, it is evident that they can be subject only to *can(n)on* law. But we wait for further developments. Our impression is that analogies are seldom helpful, though always dangerous. And after wading through illustrations where laws are twisted and tinkered till they resemble nothing in nature, the student is generally left, for all his trouble, pretty much where he was at the beginning.

IT is only on rare occasions that we receive letters couched in such terms as that communicated by the Medical Magnet Company, and we take real pleasure in inserting it in common fairness. The writer politely intimates that we are not expected to have much special knowledge concerning the curative properties of magnets, but at the same time gives us credit for our ability to deal with galvanic appliances used for similar purposes. Hitherto we had looked upon magnetism as forming part and parcel of the technical subject we try

to honestly represent, and so far as our knowledge of medicine and surgery is concerned in relation to this and electricity we place both galvanic and magnetic appliances in the same category, unless the patient is subjected to a course of treatment under the advice of competent medical men. The Medical Magnet Company enclosed with the letter a pamphlet entitled "Vital Electricity, the uniting link of mind and matter, with incidental remarks on its relation to health and disease." The writer has evidently been inspired to extol the virtues of Parkes compound magnets, but will the proprietors of these patented wire grids uphold the many absurd and misleading statements made in the face of the following extract from a paper by Dr. Steavenson in the *Provincial Medical Journal* of March 1st last?—"There are several kinds of electrical appliances, one being a collection of bits of magnetised iron sewn in between two layers of flannel. *In the first place it has not been proved that magnets have any influence whatever on the human body when brought within the field of their attraction.* Prof. McKendrick, of Glasgow, in his address before the British Association for the Advancement of Science in 1883, said that '*all attempts to influence the living body by magnets had no rational basis. He had tested this question by powerful electro-magnets, and had not been able to detect that they had the slightest influence on any vital phenomena.*' It is also reported that Prof. Charcôt, at Saltpetrière, has placed the heads of patients between the opposite poles of the most powerful magnets that can be made, *without in any way influencing them.* These appliances, containing pieces of magnetised iron, will of course easily influence a magnet when moved in its neighbourhood. And this power of influencing a magnet is generally demonstrated by the seller of this class of goods as an evidence of their power, and of the force they are likely to exercise on the human body." So courteous, however, is the tone of the Medical Magnet Company's letter, and so honestly impressed does the writer appear to be with the virtues of magnetism as a curative agent, that we should be glad to learn of any case of a *bonâ-fide* nature in which magnetism can, without doubt, be shown to have effected good.

THE Loomis Electric Manufacturing Company of New York advertises its wares in a manner which puts the majority of trade announcements to the blush, even in the land where advertising has been cultivated as one of the fine arts. It is evident, however, that the more extravagant the style of puffing one's wares the more likely is business to follow, and this, we think, is beginning to be appreciated here, although only the thin end of the wedge has yet been inserted. Electrical manufacturers generally in this country have conscientious scruples with regard to flaunting before the public the superior quality of their goods, and also a wholesome dread of being thought capable of pulling the long bow, but the Loomis Company rises superior to such considerations as these, as the following spirited announcement shows :—

Remember, the first cost alone does not determine the economy of a system. The most economical system is the one whose running expenses for power, attendance, and renewals are least. We claim that the Loomis incandescent system is the most economical, because it gives more lights per horse-power than any other; it runs them at full 16 candle-power; it requires no attendance; it cannot burn out its armature, hence its repair bill is small. Its freedom from sparking ensures long life of brushes, and its steady current lengthens the life of the lamps. The Loomis arc system is the best, because its dynamo is self-regulating, and its lamp is as steady as an incandescent.

Mr. JOSEPH BOND MORGAN, the most valued and highly paid servant of the United Telephone Company, must be more pachydermatous than he seems to the unaided eye if he remains entirely unmoved by the free criticism to which a financial contemporary subjects him. He is told that he is a brake on the wheel, and that in return for his £3,000 a-year he manages to keep the company 3,000 years behind the times, and behind all other telephone companies. Furthermore, it is suggested even that it would be better for the company if he were to retire on full pay, his place being filled by an active and competent manager. Mr. Morgan's high rate of remuneration, and the fact that he conducts a business in Liverpool which necessitates frequent journeys between the two ports, have long provoked discontent amongst the shareholders of the United Telephone Company, and there can be no doubt that it must be difficult for a man to do his full duty to one undertaking whilst subject to the distracting influences of another in the way that Mr. Morgan must be, and it is strongly felt that he should give up one of the two Still, we cannot help fancying that the *Financial News* is resorting to language a little too extravagant when it attacks Mr. Morgan in the way it has done. It is no joke to be called incompetent and a "costly and a cumbersome ornament." It is quite possible that another man of experience in Mr. Morgan's place, with no other concern than the advancement of the company's interests, would bring about more satisfactory results; there can be no doubt that better results than have yet been shown by the United Company are both possible and highly desirable. Mr. Morgan may nevertheless be, as he is said to be, a man of great experience and great ability. He has conceivably done the best he could with the means permitted to him; and he may not be so entirely responsible for the non-progressive policy of the company as our contemporary suggests.

MR. HENRY M. WHITNEY, president of the West End Street Railway Company, of Boston, Mass., made a capital presentation of his case in favour of an overhead line electric railway when addressing the selectmen of Brookline a month ago. The West End Company some time ago proposed to run an electric railway in Beacon Street, Brookline, by means of storage batteries. That project was abandoned as impracticable, and the cable system was resorted to. Considerable progress was made with preparations for a cable road, when a few months ago Mr. Whitney was induced by friends to see what was being done at Richmond. "What we found there," he says, "was perfectly surprising and amazing to all of us. There in the City of Richmond, a city of 90,000 inhabitants, was a road 12 miles long, over grades and around curves, the like of which does not exist in the whole system of 250 miles of the West End Street Railway Company. It is operated by a system of overhead wires which is positively unobjectionable; the cars ascend grades of 9 per cent. at the rate of six miles an hour, and are under the most perfect control, carrying the people with the utmost despatch and satisfaction. . . . It is carrying the people of Richmond as they have never been carried before, and with entire satisfaction to everybody." Rapid conversion ensued to Mr. Whitney and his colleagues, and the result was their desire to abandon in turn the cable project and to obtain the consent of the Brookline selectmen to the erection of an overhead line similar to that at Richmond. The account which we have read does not say whether the selectmen were favourable to the new proposition, but after the eloquent address of Mr. Whitney they must have been hard-hearted indeed to refuse.

HIGH-TENSION DISTRIBUTION.

A FEW years ago, when considering electric lighting on a large scale, the difficulties which were foreseen were almost entirely connected with the very important question of maintaining a sufficiently constant and regular light. The advantages of high-tension working, although fully recognised, applied in only a minor degree to domestic lighting, inasmuch as for such lighting no considerable body of electrical engineers ever seriously proposed or relied upon any system which had not as its fundamental principle and basis the parallel or constant electromotive force method of distribution. Although the restrictive clauses of the Electric Lighting Act of 1882, and the existence of powerful interests concerned in the protection of the gas industry, acted as serious stumbling blocks to the progress of electric lighting, we do not hesitate to express our opinion that a still more powerful deterrent was to be found in the fact that the problem of commercial distribution, when the supply in question was more than that of a few thousand lights over distances which were not considerable remained unsolved. The parallel system alone gave in a practical form the *desiderata* of self-regulation and absence of dependence of one light or one house on another; and high-tension working alone gave the equally vital conditions of economical distribution which were required to enable the parallel system to be successfully and profitably applied in practice. Two circumstances, however, prevented the parallel system and high-tension working from being used in the combination which was necessary to success. These were, first, the want of incandescence lamps suitable for high-tension parallel mains; and, secondly, the desirability, for reasons of personal safety, of supplying lights in houses at a low tension only. Both these circumstances still exist, but the labours of electricians have produced and perfected the alternate current transformer system, which in a singularly perfect manner enables the full advantage to be taken of a combination of the two principles, the union of which was necessary to success. Thus, we are enabled to supply houses with low tension lamps, and to turn those lamps on or off as they are required without any perceptible variation in individual lamps; and to do this by means of distributing mains of practicable size, which, being supplied at a high tension, allow of the distribution of a very large amount of energy without any serious loss.

And now that it can be said, for the first time, that the problem of economical electric distribution has been solved, we are brought face to face with certain disadvantages, which, as is to be expected from the nature of things, accompany the use of the system which is on the whole so satisfactory. In this case the disadvantages are the present inability to use electric motors; and a certain amount of personal danger in connection with the external or primary conductors.

As to motors, we need not say more than that it is probably only a question of weeks or months for this drawback to be removed, if, indeed, it has not already been disposed of. But we cannot so readily dismiss the element of possible danger to human life, as we feel that, however great the gain may be in other respects, the presence in a system of any really serious or unavoidable danger would cause us to pause before attempting to utilise that system, and to examine carefully the amount of the risk and the possible precautions to be observed for its avoidance. And on this matter we have now the opportunity of studying an exceedingly acute phase as it is being presented to us by the course of electrical events in the United States.

We need not go very fully into the actual circumstances of the battle now being fought in New York. There is an objectionably strong flavour of trade interests about the treatment of the whole question which renders it more than usually necessary to receive the statements on both sides with a certain amount of caution.

During the last two years the alternate current transformer system, under the energetic management of the Westinghouse Company, has developed into such proportions as to seriously threaten the interests which have hitherto been deemed secure. It is not a question of gas *versus* electricity—that phase of the struggle is to all intents and purposes a thing of the past in the States—but of continuous current *versus* alternate current; and, as in the case of a civil war, which is always the worst form of conflict, we have here the melancholy spectacle of brother electricians fiercely struggling amongst themselves, with the public attention firmly fixed on them and learning many things which it can do the public no more good to be acquainted with than with the revelations of daily risks and narrow escapes which any railway servant or steamship officer could furnish.

Actuated by motives which he was plainly told were not unconnected with the interests of a powerful low-tension combination, but which he himself described as philanthropic, Mr. Brown, an electrician, wrote a letter to a New York daily paper making a violent attack upon the transformer system, objecting to any electromotive force of more than 300 volts alternate current, or 3,000 volts continuous current, and suggesting a number of rules which, he thinks, would have the effect of entirely preventing danger. This letter was read at a meeting of the New York Board of Electrical Control, and by that body it was sent to various electric light companies and others for their observations. This appears to us to have been a rather strange course to pursue. In this country we should expect a public body to apply to independent and impartial persons for advice under similar circumstances, and not to those whose business connections naturally unfitted them for the task imposed upon them. As a result, a number of lengthy communications were received, only one or two of which deserved consideration—those of Prof. Morton and Mr. Ralph Pope. The majority of the writers were directly connected with alternate current work, and with the particular system and company attacked by Mr. Brown. From these communications we learn nothing. Then Mr. Brown replied by giving a demonstration of the effects of currents of various electromotive forces, both alternate and continuous, on a number of unfortunate dogs, and showing that there was no difficulty in killing the dogs with three or four hundred volts, alternating, but that a continuous E.M.F. of over a thousand volts was not always fatal. He showed that the resistance decreased rapidly after the current was put on—an interesting result—but caused doubt to be thrown on at least one of his results by first lowering the dog's resistance with a continuous current, and then when the poor brute was reduced to a condition of feeble vitality, despatching it by means of an alternate current. On the whole, however, the experiments show that an alternate current can be used with great effect for the destruction of dogs. We were aware that some animals, horses for instance, were seriously affected by electrical shocks, which would be considered quite harmless so far as human beings are concerned, and it is evident that dogs are also very susceptible. We consider, however, that these experiments prove little or nothing as regards humanity. There is, as our contemporary, *The Electrical World* of New York, points out, the question of *morale* present in man, and entirely absent in some animals, hence the relative fatality for animals and for man cannot be decided off hand. We think it a matter for regret that this question should have come up in such a way, and should have been dealt with in so unsatisfactory a manner. Mr. Brown evidently is simply an advocate of continuous current working, and shows his bias by dealing very gently (comparatively) with high-tension arc lighting circuits, and reserving his thunders for the opposition system. We hope to return to this question—which we need not say is one of the greatest importance at this moment—when further information reaches us as to the development of affairs in the United States.

We have recently seen the question of danger discussed in this country, and several suggestions

have been made for avoiding any danger in houses supplied by transformers. The right way of regarding it is, in our opinion, to fully recognise the danger and to guard against it. The suggestions which have been made are amply sufficient to remove even a possibility of risk to the users of lamps on the secondary circuits, and as the primary and external wires are, or should be, in the hands only of the employés of the electric light companies, who are forewarned and fore-armed, the safety of the public is provided for. Of the plans for avoiding shocks from the secondary, it is difficult to see what valid objection can be raised to the simple one of earthing the secondary. This renders it impossible to get a shock from the secondary circuit under any conceivable circumstances, and we are at a loss to understand why it is not always resorted to.

HOW TO GET UP A "SYSTEM" OF ELECTRIC TRAMWAYS.

IF an unemployed reader, who may have some technical training and a fair amount of confidence in himself, wishes to become famous, and at the same time procure a decent income combined with a substantial share in the capital of a limited company, without risking any of his own money, should he be blest with wordly goods, he can proceed on the following lines:—Firstly. Read carefully a number of old patent specifications and technical journals relating to the subject of the projected scheme, making up your mind, whilst reading, to a certain course of proceeding. Secondly. Pick out from the specifications of half a dozen inventors such details which you would have described somewhat differently had you been asked to arrange the wording and drawings from the notes of the real inventor. Throw these pickings together, change the shape of some of the pieces, alter the description without shortening it, and be careful to make a good show as regards the *quantity* of reading matter as well as of drawings. Thirdly. Choose a broad title to your specification; this is very important. If the subject relates to a modified insulator, flexible connections of a conductor, or the means of suspending the current collector under or above a tram car, then don't let your modesty have the upper hand, and instead of calling the thing by the right name, put on the title-page the broadest designation, say, for instance, "Improvements in Electric Railways and Tramways." A good title and a voluminous Blue-book goes a long way towards success. Fourthly. As soon as you receive the Royal Letters Patent—or, if you are in a hurry, as soon as your provisional specification is granted—go to some City man of a speculative turn of mind and explain your "invention" in the most high-sounding terms at your command. Tell him that for a few hundred pounds the thing can be demonstrated publicly, and that the scheme will most certainly revolutionise all existing modes of locomotion. Point out the faults of all the inventions which preceded yours, and impress upon his mind the importance of your improvements, saying that, "But for this, your predecessors might have succeeded." Promise your supporter a large portion of the proceeds in the event of a "company" being started, and he will in all probability draw a few friends into his confidence and get them to share his small risk against a big return. When the agreements are drawn up you may perhaps find that your speculator has promised himself an excessive participation in the future vendor's benefits, but then you can console yourself with the hope that your position and salary will make up for any little disappointment in this direction. The agreements being signed, and the few hundred pounds guaranteed you can proceed. Fifthly. Purchase an old tramcar, or if your money lender is friendly with the chairman of a tramway company you may get this article for nothing. Then order an electric motor from a well-known manufacturer, also the requisite gearing, dynamo, &c. Don't be too ambitious, but let *those* people, who have the necessary experience, design and work out the most important parts of the mechanism. Your name is already on the patent specification, and you are sure to get the credit of any success, whilst the risk of any failure will fall upon firms whose customer you have become.

When you get those parts made which contain your "novelty," or your combination of other people's novelties, you need not be too particular about keeping closely within the lines of the patent specification, and you will do wisely in calling upon a consulting electrician of some reputation who can advise you on any difficult points. This consulting electrician may not only help you out of difficulties during the construction of your experimental car and line, but he will also write an elaborate report thereon at the desired moment, and further undertake to call this combination a "tramway system" bearing your name, and eventually this report will be published in newspapers, and thus you become "immortalised," with no expense and little trouble to yourself. Lastly, on the strength of a few runs with this car on a few yards of tram rails, and especially on the strength of the said report, your friends will start a "syndicate," reserving eight-tenths of the nominal capital, partly for yourself and partly in consideration of the risk they ran by supplying the money for the first "show." Henceforth you will be a pioneer of electric traction, a shareholder in a company, and director besides; possibly, managing director. You will feel like a public benefactor, and live comfortably for a time on a handsome salary. You have made friends, and you have a *name* which will be handed down to posterity. The space at our disposal does not permit of more than this rough outline of the procedure. Details must be filled in according to circumstances, and variations can easily be made by those who have sufficient tact and the necessary courage.

ELECTRIC TRAMWAYS IN SALT MINES.

OF all the methods hitherto tried for dispensing with human muscles as a motive power the electric system seems the most satisfactory.

The generator, in this system, is erected above ground, and merely the electric current is passed into the mine by means of metallic conductors, which are scarcely perceptible, and there it actuates very simple electric locomotives which take up little room. All deterioration of the air by smoke, steam, or the emanations of horses is avoided, and no heat is generated, a very important point in the working of mines. No additional danger is incurred, and the working cost, as compared with human labour, is much reduced. In the New Stassfurt mine this system has been in regular operation since January, 1884.

The steam engine supplying the needful power is placed above ground at a distance of 25 metres from the shaft. It is of 16 horse-power, making 50 rotations per minute, and actuates the primary dynamo which makes 650 turns per minute.

This electric primary machine is of the type D_0 (Siemens and Halske), and is fitted with two electro-magnets, placed one above the other, and enclosing between them the drum-shaped armature. These electro-magnets have a mixed winding, so that the machine belongs to the type of so-called compound dynamo-electric machines. The advantage of this class of machine is that the electromotive force remains the same whether the secondary machine (*i.e.*, the electro-motor working the locomotive) works, within certain limits, with greater or less expenditure of power, so that its speed of rotation remains approximately constant without further regulation. Machines of this class yield, further, a very high useful effect.

The secondary dynamo which serves as electro-motor is of the well-known type D_1, but the horseshoe magnets are placed horizontally in order to economise height.

The primary machine works with an E.M.F. of 350 volts at the terminals, and requires about 20 horse-power

in order to obtain a work of 10 horse-power in the electro-motor. Hence the electric installation yields a useful effect of 50 per cent.

The current of about 42 ampères produced by the primary machine, passes down the shaft by means of a cable formed of two copper wires and along a cross shaft for the distance of 410 metres to the conductor rails of T-iron fixed insulated above the line.

The electric locomotive is 930 millimetres broad, 1,500 millimetres high, 2,670 long between the buffers, and there is a distance of 480 millimetres between the middles of the axles. The gauge of the track is 628 millimetres, and the driving wheels are 350 millimetres in diameter. In front of the seat of the driver are two cranks, one of which serves to manipulate the ordinary mechanical brake, and the other for inserting or withdrawing resistances as it may be needful. These resistances are above the locomotive on both sides in long boxes, the sides of which are of gratings and consist of narrow slips of wire gauze. The weight of the locomotive is 2,174 kilos. Its power of traction, under the circumstances prevailing in the New Stassfurt mine is about $\frac{1}{10}$th of the weight of the locomotive, say 200 kilos. As the locomotive propels the loaded train of 16 waggons with a mean speed of 3 metres per second, we may calculate the effective performance of the electric locomotive at $\frac{200 \times 3}{75} = 8$ horse-power.

The gross weight of a loaded waggon is on the average 1,200 kilos, so that the train consisting of 16 such waggons and the water tank amounts at least to 20,000 kilos in weight. If we assume that this weight, upon the nearly level track with 10 kilos per 1,000 and a speed of 3 metres can be worked by the 8 horse-power of the locomotive, the result comes out as follows :—

$$\frac{20 \times 3 \times x}{75} = 8 \text{ or } x = \frac{8 \times 75}{3 \times 20} \text{ that is, } x = 10.$$

That is, the resistance of the train which the locomotive has to overcome at the speed of 3 metres is 10 kilos per thousand, which is doubtless true if we consider the very smooth track and the good condition of the rolling stock. It must, however, be remembered that under less favourable circumstances this resistance may increase to double or threefold, whereby, of course, the speed of locomotion will be reduced correspondingly with the same or even with a considerably increased demand upon the locomotive force. In the present case, the locomotive would probably be able, without any perceptible diminution of speed, to propel a heavier train, of, say, 20 trucks, as the electric machines are very strongly built.

As regards the working cost, the following figures furnished by the management of the mine are decisive :—

In 1884, 176,196 trucks were forwarded from January 1st to December 31st, when the working costs, calculated in monthly averages and including all items, wages, fuel, materials and 15 per cent. on a capital of 35,000 marks sunk (*i.e.*, 5 per cent. interest and 10 per cent. for paying off capital), come to 10·1 pfennig (the "pfennig" is $\frac{1}{100}$th of a shilling), whilst the previous propulsion by hand labour came to from 18—20 pfennigs per truck as a yearly average.

The yearly performance of the electric tram installation, at 800 kilos. nett load of the trucks, is 74,525·1 kilometre tons.

For the entire yearly working there was expended :—
176,196 × 10·1 = 1,779,579 6 pfennigs, or in round numbers, 1,780,000. The figures per kilometre ton is therefore

$$\frac{1,780,000}{74,525·3} = 23·89 \text{ pfennig.}$$

The propulsion by human power costs per kilometre ton close upon 45 pfennigs, since the labourer received 3·6 pfennigs per 0·08 kilometre ton.

In brisk working during the month of February, 1884, the number of trucks conveyed in 87 eight-hour shifts was 23,868, and the entire expense (including interest, &c.) 1,491·36 marks, so that we have per truck 6·2 pfennigs, and the kilometre ton propelled electrically costs only 14·7 pfennigs.

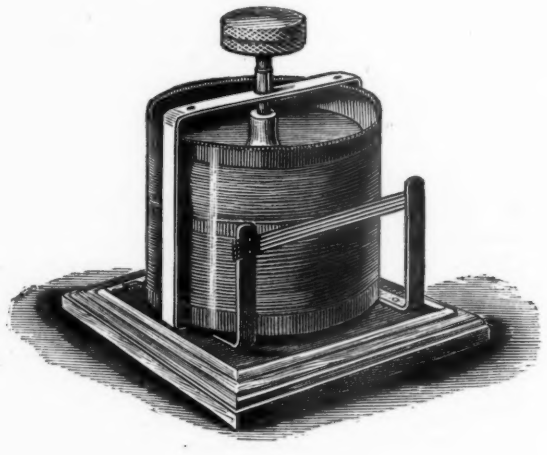
The year 1887 gives a still more satisfactory result, the underground electric way having been considerably increased. In the month of March of that year there were conveyed 20,114 trucks for a mean distance of 800 metres, representing 12,873 kilometre tons. The average total cost (inclusive of interest, &c., at 15 per cent. on a total capital of 40,000 marks) was per truck 8·3 pfennigs, or per kilometre ton 12·92, whilst the cost of a similar conveyance by human labour is estimated at 34·2 pfennigs per kilometre ton, so that the electric system of transport is cheaper by over 60 per cent

A NEW RHEOSTAT.

FOR many purposes the use of a rheostat or adjustable resistance is indispensable, and consequently the variety of forms in which these are made is very great. The chief difficulties which are found in the construction of these is to produce a sufficiently gradual increase of resistance, to ensure good contact at successive points, and to comprise sufficient resistance of ample current capacity within reasonable space.

These various points are well combined in the rheostat of which we append an illustration. The construction is as follows :—

The wire, which is covered, is first wound as closely as possible upon a paper tube, which is kept in shape on a mandril during winding. When the tube is sufficiently covered, the whole wire and tube are well varnished, so as to hold the wire together during subsequent operations. While the tube and varnish are

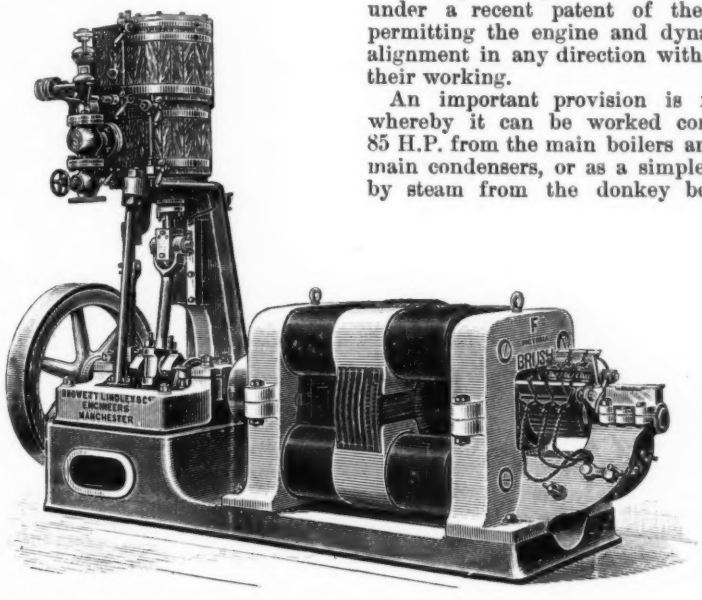


still soft the former is pressed flat in a heavy press. The flattened paper covered with wire is then wound round the metal cylinder which forms the body of the instrument, and is attached to it firmly by string, the whole being varnished. The cylinder is then put in a lathe and the covering of the wires carefully bared by means of a file at a suitable point for the contact of the brush, which consists of parallel hard copper wires pressed against the cylinder by their natural spring, the two ends of the brush being supported by upright pieces, one of which is connected to one terminal of the

instrument. The metal cylinder is attached to one end of the convolutions of wire by solder, and is also connected to the other terminal of the instrument. The convolutions of the wire being vertical, and the brush horizontal, it follows that by the rotation of the cylinder by the handle at the top successive convolutions are cut out of circuit, and so the resistance is altered. The smallest difference of resistance, therefore, that can be made is that of a length of wire equal to the circumference of the paper tube.

By means of a pointer attached to the handle, which is insulated from the cylinder, the actual resistance corresponding to any degree of rotation can be tested and marked upon a scale of a dial over which the pointer moves. The compactness of the instrument is much in its favour, as the amount of wire that can be wound upon it is very much larger than in other instruments. Its accuracy is also considerable, as may be gathered from the fact that it has been largely used in the States in connection with a voltmeter, the readings of which depend upon the correctness of the reading on the dial.

The size of the instrument principally in use is on a base 5¾ inches square, the cylinder being 3½ inches diameter and 3½ inches high. The wire can be wound on this size to any resistance between 1,200 and 45 ohms.



This latter resistance is specially intended to regulate an incandescent lamp of 10 to 25 C.P., of 100 volts, and takes, therefore, up to 1 ampère of current without heating. This type is very handy for photometrical work. Larger sizes would be very suitable for the hand regulation of the shunt circuits of dynamos, and the very many cases in which resistance regulators are used.

The instrument is made by the Woodhouse and Rawson Electric Manufacturing Company, under the patent of Mr. Wirt.

SHIP LIGHTING PLANT.

OUR illustration represents a new and compact plant of combined engine and dynamo for lighting ships, as made by Browett, Lindley & Co., of Salford, Manchester, under a recent patent. The S.Y. *Victoria*, now so well known as a pleasure steamer, was fitted at the beginning of this year by the above firm with this plant to replace that originally fitted, and the installation is interesting on account of the very trying conditions under which it was executed. The whole plant had to be erected on a wrought iron staging built on a level with the top of the main engines in one corner of the engine room next to the engine bulkhead, and was guaranteed not to cause noise or vibration. This engine has cylinders 6 inches and 10 inches bore, the stroke of the piston being 8 inches, and runs at 200 revs., driving 150 lights, though it is capable of much higher duty if run faster. The engine is a patent vertical compound tandem, whose special features are that by the method of construction the height is kept down and yet both pistons and all other parts can be taken out very readily in very limited head room, while the valves and gear, details of which we are not at liberty at present to describe, are such as to provide a light and simple construction, working with very little friction, and permitting complete examination of the whole by the removal of one cover, and, if necessary, the entire removal of valves and seats for examination or repair.

There is only one piston rod gland to pack and the rod can be withdrawn downwards without removing anything but the top (low pressure) cylinder cover. Very large wearing surfaces are provided, all capable of ready and accurate adjustment and efficient lubrication while in motion from fixed oil cups.

The dynamo is one of the well-known Brush "Victoria" type of F 2 size, and its armature spindle is connected by a very efficient universal coupling made under a recent patent of the Brush Corporation, permitting the engine and dynamo shaft to be out of alignment in any direction without any detriment to their working.

An important provision is made in this engine whereby it can be worked compound by steam at 85 H.P. from the main boilers and exhausting into the main condensers, or as a simple high-pressure engine by steam from the donkey boilers while in port exhausting into the atmosphere. The whole plant as illustrated formed part of the contract entrusted to Messrs. Browett, Lindley & Co. by the owners, who preferred this engine, and desired the whole contract to be in one firm's hands, and they are very well satisfied with the results obtained. The same principles of construction are adapted to high-speed horizontal tandem compound engines, both for small and large engines, and we understand that the maker's pavilion at the Barcelona Exhibition will shortly be lighted by one of these engines, giving 40 H.P. at 350 revolutions.

LIGHTNING.

By S. A. VARLEY.

(*Continued from page* 204.)

BEFORE making a few comments on Professor Lodge's lectures on the protection of buildings from lightning, I wish to correct an error in the last issue. A Leyden arrangement is there described whose negatively charged surface is assumed to = 100 and the positively charged surface on the other side of the dielectric to

= 10, and I state the positive electricity will, under such conditions, be ten times as dense as the negatively accumulated electricity on the larger surface. It is then stated in error that the positive charge will have 10 times the breaking down power. What I ought to have said was 10^2 times the force; for the power to break through the dielectric increases as the square of the density of the charge, harmonising in this respect with the heating effect of an electric current passing through a conductor and also with the breaking down energy of a rifle ball whose penetrating power is as the square of the velocity; which is intelligible enough when we reflect that a rifle ball moving with twice the velocity of another one, will have twice the energy; and as it is travelling at twice the speed, this twofold energy is given out in half the time when an obstacle is met with in its path, and consequently the crushing effect or power to penetrate becomes increased four times.

The practical value of Professor Lodge's lectures and also the articles on "Modern Views of Electricity," seem to me to have been impaired from too much importance being attached to hypotheses and speculations, which are reasoned upon as if they were established truths on which further hypotheses may be safely founded; the consequence is that the bases on which Professor Lodge develops his views become more and more involved as he proceeds, until the subject being dealt with gets involved in such an inextricable and complicated mass of purely hypothetical assumptions, treated as indisputable facts, that I find it almost impossible to follow the reasoning, much less to accept the conclusions ultimately arrived at.

The following passages extracted from Part II., chapter 4, under the heading "Energy of Currents," will, I think, speak for themselves.*

"We must learn to distinguish between the flow of electricity and the flow of electric energy, they do not occur along the same paths."

Further on it is stated: "Electric energy is not to be regarded as pumped in at one end of a conducting wire, and as exuding in equal quantities at the other; the electricity does indeed travel thus, whatever the travel of electricity may ultimately be found to mean, but the energy does not; the battery emits its energy not to the wire direct, but to the surrounding medium; this is disturbed and strained, and propagates the strain from point to point till it reaches the wire and is dissipated. This, Prof. Poynting would say, is the function of the wire; it is to dissipate the energy crowding into it from the medium which else would take up a static state of strain and cease to transmit any more. It is by the continuous dissipation of the medium's energy into heat that continuous propagation is rendered possible." "The energy of a dynamo does not, therefore, travel to a distant motor through the wires, but through the air. The energy of an Atlantic cable battery does not travel to America through the wire strands, but through the insulating sheath. This is a singular and apparently paradoxical view, yet it appears to be well founded."

Further on we read, "How does the energy of the distant dynamo reach the car in this case, not *via* the wire connector; not even *via* the underground conductor. It travels from the distant dynamo through the general insulating medium between cable and earth. Some little enters the conductor and is dissipated, but the great bulk flows on and converges on the motor in the car, which is thus propelled. All the energy of the conducting wire is dissipated and lost as heat; it is the energy of the insulating medium which is really transmitted and utilised." This curious complicated hypothesis, which may possess a charm for those who love to indulge in the scientific uses of the imagination, and think the province of the scientist is to theorise, is referred to again in Part IV. under the heading "Radiation," not as an hypothesis, but as an established truth, or at least as a completely demonstrated theory. We are here told "It is a curious function this of the telegraph wire; it does not convey the pulses, it directs them. They are conveyed wholly by the ether at a pace determined by the properties of the ether, modified as it may be by the neighbourhood of gross matter. Any disturbance which enters the wires is rapidly dissipated into heat and gets no further; it is the insulating medium round it which transmits the pulses to the distant station.

"All this was mentioned in part III., and an attempt was made to explain the mechanism of the process and to illustrate in an analogical way what is going on. The point of the matter is—currents are not propelled by end thrusts like water in a pipe or air in a speaking tube, but by lateral propulsion as by a series of rotating wheels with their axes all at right angles to the wire surrounding it as a central core, slipping with more or less friction at its surface. This is characteristic of ether modes in general; it does not convey longitudinal waves or end thrust pulses like sound, but it conveys transverse vibrations or lateral pulses like light."

We are also told in an earlier portion of the article:—"We already know of a continuous incompressible fluid filling all space, and we call it the ether."

The existence of such an entity is, of course, purely suppositious, and all that can be said for it is that with the limited powers we possess it helps us in some sort to group together and explain observed phenomena which we otherwise could not so well do.

I venture to think, if the dictum that science is disciplined common sense be not overlooked, we shall come to a different conclusion from that which Professor Lodge seems to have arrived at. The resistance of a conductor, and the transmission of energy through it, harmonises in every respect with the transmission of force through a hydraulic system, and given uniform lengths and pressures the energy transmitted, be it electrical or hydraulic, is directly as the sectional area of the conductors and the pipes; this being so, common sense would suggest that the energy in both cases is transmitted in a similar way, viz., through the interior of the conductor as well as through that of a pipe. Such a view receives further support from the fact that electrical energy also harmonises with mechanical energy; its power to break down resistance, as already pointed out, following the same law as that which governs a rifle ball when in motion.

In taking leave of "Modern Views of Electricity," I cannot help expressing my conviction that if the views there contended for be generally accepted by the rising generation, we of the older schools, who have accomplished some electrical work in the past, will not just yet have to retire to a back seat.

I now pass on to the consideration of lightning discharges and lightning conductors. In the autumn of 1856 it was my good fortune to witness a magnificent storm in Asia Minor, when riding from Mudania to the City of Brusa, a distance of 20 miles.

The Valley of Brusa, on the outskirts of which we travelled, is the bottom of an oval crater or basin, whose major and minor axes are about 25 and 12 miles respectively. Our road, for the most part, was a succession of hills, which we ascended and descended one after the other, and which, I have no doubt, had been formed by the breaking down of the crater walls.

Between 3 and 4 p.m. we saw the storm beginning to gather in the distance, followed shortly afterwards by a vivid flash, which seemed to shake the ground over which we were riding; the thunder that followed reverberated between the rocks and the sides of the crater, producing a metallic rattle altogether unlike any thunder I have before or since had experience of.

A deluge of rain followed the discharge, and the storm gathered in force, reaching its maximum a little after sunset, and continuing in full force for some hours afterwards. When the storm was at its maximum intensity, the lightning flashes succeeded one another so rapidly as to light up the road and enable us to pick our way through the mountain streams produced by the heavy rain, and through which we had to pass.

* See *Nature* of November 3rd, 1887, and August 23rd, 1888.

The lightning discharges followed each other in sets of three with almost monotonous regularity, and were confined to a limited and apparently circular area. We were then too close to the base of the mountain range to be able to see where the lightning actually struck, but as far as I could judge, they all seemed to strike the summit of Mount Olympus, which was the highest point, and nearly 7,000 feet high.

I have already stated the discharges were in sets of three, the second and third discharges were single angular sparks, similar to what we are familiar with in England, only they were heavier and more vivid. The main discharge was, however, altogether different from any lightning I have witnessed elsewhere; it reminded me of a crooked trunk of a tree bulging out at the top, and was not unlike a waterspout. I have since thought it might have been a mass of raindrops, aggregated together by electric attraction, and illuminated by the flood of electricity passing through it.

The summit of the mountain would be immersed in cloud, and formed in all probability a focus where a very rapid condensation of the clouds into raindrops was occurring, the discharges having their origin in clouds higher still.

Some few weeks later I ascended Mount Olympus, the summit of which I found to be a crater in a conical hill, rising about 1,000 feet from a plateau; the diameter of the mouth of the crater (as nearly as we could estimate) being about two miles or somewhat more than this, and I think it very probable the area of discharge was limited to the size of the crater. One side of the crater was broken down to the level of the plateau, and there was a frozen lake at the bottom of the basin out of which ice-cold water was flowing, forming a stream, in which trout were swimming.

There are two other cases of lightning discharges I would briefly refer to; the first of these occurred in Hyde Park, and was witnessed by my father when he was a boy. The lightning struck a broad gravelled path, and a cloud of fire was seen to rise from the path and meet the flash in the air. My father ran to the spot where he thought the lightning had struck, but there were no signs of it anywhere to be seen; the gravelled path, however, had the appearance as if fine sand had been recently sieved over it, producing a smooth surface, and there was a smell of ozone. There is very little doubt that the finer particles of the gravel were raised from the ground by electrical attraction, that the lightning discharge diffused itself throughout the suspended matter, and dissipated its energy over a surface of ground instead of boring a hole.

The second of the two cases occurred in a meadow in the immediate neighbourhood of Epsom Downs. On either side of this meadow there were garden walls, and the space dividing them I estimate as being about 400 yards. In a garden immediately behind the wall on one side of the meadow there was a low tree, the branches of which extended over the wall, and during a storm which happened on an "Oaks Day" a man took advantage of the overhanging branches for shelter. A lightning discharge struck the wall on the opposite side to the one against which the man was resting, and knocked out some bricks; it then passed horizontally across the meadow striking the man (who was killed on the spot), destroying brickwork behind him, and disappearing without leaving any further trace. I did not see this discharge myself, but I visited the spot some weeks later, after the damaged brickwork had been repaired, and what I have related was described to me by an eye-witness. The subsoil of Epsom Downs is solid chalk, some hundred feet in thickness, and I think the probability is that the tree was growing where it was because there was a fissure in the chalk which enabled the roots to extend downwards and to obtain sustenance, that this fissure was the path of least resistance, and the man having unfortunately placed himself in its immediate vicinity, he suffered in consequence.

In the lecture delivered by Prof. Lodge on March 10th, 1888, the following passage occurs: "Perhaps the best protected building in the world is the Hotel de Ville, at Brussels, the hobby of M. Melsens; the whole system used in this building is excellent and theoretically perfect, so far as I know, in every respect."

Faraday used to say facts stood before all theory; and I came across a passage in an evening newspaper of June 26th, 1888, containing the copy of a telegram received from Brussels, which I annex: "A thunderbolt fell this evening upon the Hotel de Ville. A fire resulted, but it was soon extinguished. A good deal of surprise has been occasioned, for the building was recently provided with lightning conductors made on a supposed improved principle, and which scientists declared would render this fabric perfectly secure against lightning, but the result has proved the contrary."

To say the least, it is very unfortunate that a costly and supposed perfect system should so signally fail within a few months of erection; I feel somewhat curious to know what was the subsoil on which the building is erected and how the earth connection was made. I am disposed to believe that the surging of currents through lightning conductors to which Prof. Lodge gives so much prominence is much more imaginary than real; at the same time, I can readily imagine that numerous conductors over a building may, under certain circumstances, be a source of real danger where there is an imperfect earth connection, for the electricity will then diffuse and dissipate itself wherever it can, and it will find its way to the earth by numerous more or less imperfect channels! It may be through conductors inside, and where such conductors are small or angular, through the atmosphere or through gas fittings, &c., and such vagaries as breaking its way through chimney shafts to the heated soot inside, or through a wall to a gun or fireirons, or a water tank, is, I believe, to be attributed primarily to the want of a good connection with the earth, and not to oscillations or surgings of the current in a conductor.

If a Leyden jar be discharged into a metallic chain lying on a table, sparks will frequently be noticed to occur between the links and the table throughout the length of the chain, because the table is an imperfect conductor, and a similar, but more powerful action of this kind is very liable to occur, also, in the case of buildings having lightning conductors not perfectly connected to the earth.

I am, however, of opinion that it is possible to protect a building from lightning with comparative facility, whatever may be the nature of the subsoil.

The usual system of proceeding in the matter of the protection of buildings is radically wrong, but it is not the fault of the constructor of the lightning conductor, who does the best he can under the conditions in which he finds himself placed.

(*To be continued.*)

RULES ISSUED TO CONTRACTORS BY THE LONDON ELECTRIC SUPPLY CORPORATION.

CONDUCTOR.

Copper.—In all conductors the copper to be tinned and of such sectional area that the current they supply shall not exceed 1,000 ampères per square inch.

Insulation.—All fixed conductors to be covered with at least one coating of pure rubber, and one of vulcanised rubber of approved thickness, and mechanically protected with some such covering as braided hemp, which must be rendered impervious to moisture.

Stranded.—All conductors whose sectional area is larger than that of No. 18 B.W.G. to be stranded.

No conductor of a less area than No. 18 B.W.G. to be used, except in the case of wires enclosed in fittings, where No. 20 B.W.G. may be used.

CASING.

Wood Casing to be of American white wood or other equally good, approved material, to be at least $1\frac{3}{4}$ inches across, and the fillet to be not less than a full $\frac{1}{2}$-inch in

any place, particularly in the mitres, where great care should be taken not to cut away the fillet.

All the lids to be firmly screwed and not nailed down.

Wire in Zinc or other Tubes. — Single conductors must never be encased in zinc or other metal tubes of a greater length than 6 feet.

Where there is absolute necessity for such mechanical protection, both conductors should be placed together in a tube large enough to prevent any abrasion of the insulation.

Lead-covered wires must not be used under any circumstances.

Open Wires.—Where conductors run on outside walls not in casing, they must be fixed on insulators, and placed not less than 6 inches apart anywhere.

Staples.—No conductors under any circumstances whatever to be fixed by means of staples.

ARRANGEMENTS OF CIRCUITS.

Mains.—All circuits to be so sub-divided that no mains between the converter and the distributing boards carry more than 75 ampères.

Switches.—All switches should be of the best make, and of such design that they cannot possibly remain in any intermediate position between "on" and "off," and should have good endurable rubbing contacts. No metal in switches carrying current to be exposed.

No fuse and switch to be combined.

FUSES.

All fuses to be of some recognised pattern, and their cases to be made of porcelain, and mounted on teak bases, which should be independently fixed to the wall. No fuses mounted in combustible material may be used.

All fuse cases to be in easily accessible places, and all fuses to be stamped with the current at which they will fuse, and to be easily renewable.

All branches to be protected by double-pole fuses placed as near to the mains as possible.

Every fitting to be supplied with at least one double-pole fuse.

Every lamp hung on a flexible cord shall have a fuse in the ceiling rose; the wires of the cord shall be separately drawn through holes in the rose before coming to the terminals.

FITTINGS.

No gas fittings are to be wired under any circumstances whatever, unless the same are efficiently insulated from the gas supply pipe.

DISTRIBUTION OF CIRCUITS.

The mains from the converter shall in all cases be taken to distributing boards and there divided into as many small circuits as practicable. Every circuit to be controlled by a separate switch, and protected by a separate double-pole fuse.

No circuit leaving a distributing board shall carry more than 75 ampères.

TESTING.

The Corporation retain the right of refusal to supply current to any installation, before testing the insulation resistance of the circuits.

Installations when tested by the Corporation shall not have lower insulation resistance than the following:—

Up to 25 lamps	...	...	2 megohms.	
„ 50 „	...	...	1·25	„
„ 100 „	...	...	·75	„
„ 150 „	...	...	·5	„

Installations failing this test will not be supplied with the current by the Corporation.

The Corporation will not continue the supply of current to any installation falling below the above tests, and which is so allowed to remain by the consumer.

No installation will, under any circumstances whatever, be turned on until the whole of the work is entirely finished.

In the event of any contractor turning on any additional lights before they have been tested and passed by the inspector for the Corporation, the whole of the installation will be cut off the circuit until such tests have been made.

INSPECTION.

All installations will in future be inspected under the current edition of the Phœnix Fire Office Rules.

SPECIAL APPARATUS.

All special apparatus, such as resistance and retarding coils, to be specially approved by the inspector of the Corporation.

This specification is subject to revision when the Corporation may think necessary.

S. Z. DE FERRANTI, *Engineer.*

NOTES.

Electric Lighting in the Navy.—The contract for fitting Her Majesty's ships *Magicienne* and *Marathon* with the electric light, both search and incandescent, has been placed in the hands of Mr. R. A. Scott, of Hammersmith. Scott's patent main switchboards will be used for controlling the various circuits.

Electric Lighting of Libraries.—"The Looker-on," in the *Birmingham Weekly Post*, says:—"A telling fact in favour of the electric light, which is shortly to be placed at our disposal, is furnished by the condition in which many of the books at the Birmingham Library were found when the place was lately closed for cleaning, binding, and rearranging purposes. Some hundreds of them had to be sent to the binder's only because the leather which covered their backs had been rotted by the waste products of the gas burned in the library."

Lighting of Spanish Theatres.—The Spanish authorities, it is said, intend to rigidly enforce the decree recently promulgated, to the effect that all the theatres shall be lighted exclusively by electricity. The lessees have endeavoured to persuade the authorities to extend the time initially fixed for the introduction of the light, but without success, and consequently none of the Spanish theatres can open this autumn unless lighted electrically.

Electric Lighting in Melbourne. — A Melbourne syndicate is said to have purchased the sole right of "Lipernoski and Bere's" electric lighting system, and to intend to erect a central station for lighting the city and suburbs within a radius of five miles. Zipernowski and Deri's system is no doubt meant.

The Telephone and Hospitals.—The Cambridge Improvement Commissioners have accepted the tender (£26 per annum, on a five years' contract) of the South of England Telephone Company for the establishment of intercommunication between the Commissioners' offices, depôt, and hospital, and the residence of the medical officer of health. There had been complaints of delay in receiving patients, and the introduction of the telephone is expected to remove the causes of the delay.

Liberal Telephone Company.—The Western Counties and South Wales Telephone Company has, with much thoughtfulness and liberality, just attached the Swansea and Llanelly Hospitals with all the works, manufactories, and all places of business connected with its telephone system in the neighbourhood free of charge. We believe that this company stands alone in the practice of giving free connection to the chief police and fire brigade stations and the hospital or infirmary, as well as the important charitable installations, in all towns in which it has an exchange.

The United Telephone Company.—The *Financial News* gives the United Telephone Company no peace nor rest. It has just published a report upon the working of the principal telephone companies in Great Britain, considered from a technical point of view. The writer is said to have had considerable practical experience in telephone work, to be a good general electrician, and himself an inventor of telephonic apparatus now in successful use. The article itself struck us as being to a great extent inconsequent; but the facts are doubtless correct, and we are disposed to agree with the author's conclusions, which are editorially summarised thus:—"His conclusions may be summed up in this, that, judged from a technical standpoint, the management of the United Telephone Company is even worse than it has been fully proved to be from a commercial point of view."

Telegraph Insulators.—A copy of a specification, dated 22nd July, 1869, No. 2,235, and entitled, "Improvements in telegraph wire insulators," has been sent to us, and from this it appears that the insulator recently patented by Mr. W. E. Langdon and others, and illustrated in our last issue, has been completely forestalled. Perhaps Mr. Langdon and his colleagues were unaware of this prior patent, which was issued nearly 20 years ago to William Robert Lake, as a communication from abroad, the inventor being Mr. W. E. Simonds, of Hartford, Conn.

The Telegraph and the Recent Naval Manœuvres.—Sub-Lieutenant H. A. B. Shrubb, the officer in charge of the Intelligence Department on board the *Hercules* during the recent manœuvres, has submitted an interesting report to Sir George Tryon on the telegraphic information received by him as to movements of the opposing fleets. It appears that 20 letters and 602 telegrams were received by the flagship during the time the B Squadron lay in Berehaven. These came principally from coastguard stations on the coast, signal stations established at Cahermore and Browhead, and from Lloyd's and other local sources. The character of the information received was most satisfactory, only 3 per cent. of the news sent being unimportant. This is highly creditable to the senders, as to most of them the work was entirely a new experience. The value of similar information in the case of war would, of course, be incalculable, but Mr. Shrubb points out that it would also be considerably increased if the various coastguard stations were connected with one another by electric telegraph. A hope is expressed that no time will be lost in carrying out this suggestion.

Firing by Electricity.—During the regatta in connection with the Royal Yacht Squadron, at Cowes, which took place last week, the cannon in front of the battery were fired by electricity, the tubes in connection with the fuses being laid up the flagstaff and then run across to the battery of the castle whence the apparatus was set in motion, and no little sensation was at first caused by seeing the guns suddenly explode without any visible human agency.

Killed by Lightning.—Robert Furtis, a lad of 16, living near Blyth, was killed by lightning on Saturday evening. Whilst out for a walk with his sister, he took shelter in a hedge from a severe storm. During the storm there were several very vivid flashes of lightning. Suddenly Furtis gave a groan and expired by his sister's side.

Japan to the Fore.—An electrical society has been established at Tokio, at the first meeting of which the secretary was able to announce a membership of over 800. The president is Viscount Enomotto, minister of "the Department of Communications," and the local honorary secretary in Japan of the Society of Telegraph-Engineers and Electricians, Mr. R. Shida, is chairman of council.

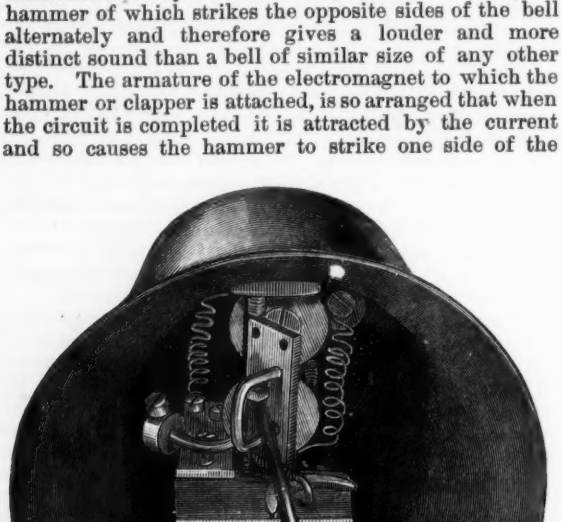
Another Galvanic Appliance.—The latest appliance brought to our notice for rapidly restoring wasted nervous power to the human system, for strengthening the weak and fortifying the strong, is an electric sponge. It is claimed to be an important and ingenious invention, by means of which everyone may enjoy the luxury of a real electric bath with a vitalising, invigorating influence which they never before possessed. Randal Cresswell's electric sponge is the ordinary bath sponge in outward appearance, but concealed in its interior is a small primary battery. By simply wetting the sponge and applying it to the skin, the electric current is said to be conveyed to any part of the body, and although the current is sufficiently powerful to withstand (*sic*) any of the ordinary tests, such as ringing a bell, decomposing water, or deflecting the needle of a galvanometer, it gives no shock or unpleasant sensation, and it is guaranteed to be absolutely harmless to the most delicate infant. "The Cresswell Electric Association invite purchasers of their celebrated electric sponge to submit it to any practical test, with a view to ascertaining the strength of the current obtainable from it. The electric sponge may be submitted to any recognised authority on electrical matters, and if on investigation it should be found otherwise than it is represented, *i.e.*, a genuine electric sponge, the proprietors will cheerfully return the money paid for it, and will also donate the sum of £20 to any hospital that may be decided on. This challenge is rendered necessary by the many barefaced misstatements put forward by proprietors of so-called electrical appliances, in which there is nothing electrical but the name, and which will not withstand the simplest test to which an expert can submit them." We shall be glad if the association will send us a sponge, either with or without the £20, and we will undertake to give a faithful account of the tests to which we submit it, and the results obtained. On the face of it, why should the current ever go outside the charmed circle of the wet sponge?

The Graphophone.—The Court Circular in the *Standard* of yesterday, under date of the 29th inst., stated that Mr. Sidney Morse had the honour of exhibiting the graphophone to the Queen and Royal Family at Balmoral. From the *Globe* of Wednesday evening we gleaned the intelligence that a press exhibition had already been given at the offices of Messrs. Walter T. Glover & Co., 10, Hatton Garden, E.C. Colonel Gouraud with the phonograph seems to have completely overshadowed anything of a similar nature, but we may remark that, although the apparatus contains nothing electrical, there is a lengthy illustrated description of the graphophone in the ELECTRICAL REVIEW of the 3rd inst.

Testing Reckenzaun Cars.—An eight-wheeled storage battery car of the Electric Car Company, of America, has been successfully tested on the Lombard and South Streets Line, Philadelphia. The round trip was made in 37 minutes; horses take 55 minutes to go over the route. The motive power was received from two Reckenzaun motors of 8 H.P. each, capable of working up to 15 H.P. One hundred storage cells were located beneath the seats. The car has been run 63 miles with one charging, but it is intended that the cells shall be recharged at the end of every 40 miles. All the electrical appliances, including the motors and cells, weigh 5,800 lbs., and the car weighs 9,200 lbs.

Electric Traction.—Another argument in favour of electric traction which mine owners may well take to heart is very clearly shown in the article which we publish to-day on the electric tramway in the salt mines of New Stassfurt. The great saving shown over the method of operating in use previous to the introduction of electricity is remarkable, and should go far towards giving confidence in the employment of electrical propulsion. Messrs. Immisch have had some experience in mining work, and the results which we have tabulated should give encouragement to that firm to persevere in its efforts.

The "Watt" Electric Bell.—The illustration represents a new form of electric bell invented and manufactured by Messrs. Watt, Winnall & Co., the hammer of which strikes the opposite sides of the bell alternately and therefore gives a louder and more distinct sound than a bell of similar size of any other type. The armature of the electromagnet to which the hammer or clapper is attached, is so arranged that when the circuit is completed it is attracted by the current and so causes the hammer to strike one side of the



bell. On the armature is a projection which by the passage of the armature to the magnet, is caused to force a pallet (which is an insulator) between a spring, so breaking the circuit and allowing the armature to fall by its own weight and the hammer to strike the opposite side of the bell. As the armature falls the projection hits the other end of the pallet and withdraws the first mentioned end away from the spring, thereby causing the spring to come again in contact and complete the circuit, when the same thing is repeated.

The American Institute of Electrical Engineers.—The July transactions of this flourishing society have reached us. The contents of the journal have already been presented to our readers with one exception, which is not of an electrical nature.

New Journal.—The *Electro-Mechanic* is the title of a new American journal published in Kansas City. The first number which has reached us appears to show promise of future excellence in the news department, there being but little matter of a purely technical character to give any clue as to what value it will prove to the mechanician. America seems just now a wonderful field for electrical journalism, and we wish the new paper a successful career, notwithstanding the fact that it looks somewhat like a trade venture on the part of a certain company.

Mad on Electricity.—William Frederick Judd, an agent, called on Saturday at the chief office of the City Police, and complained of having been electrified by the telephone companies. He said he felt the vibration everywhere he went, and in the chair upon which he was then seated. He was brought before the Lord Mayor. In reply to the court he denied that he was of unsound mind, and repeated his statements as to having been electrified. A doctor examined him, and said his mind was dwelling on the subject of electricity, and seemed to be unsound in that respect. Sir Andrew Lusk said that if the defendant went into the country for a little while it would do him good. He directed him to be sent to the City of London Lunatic Asylum at Stone.

The Bankruptcy Court.—Luther Hanson, who had carried on business as an electrical engineer, at North Bridge Works, Halifax, was recently examined. In answer to the Official Receiver, the debtor said that he had been in business as an electrical engineer about a year and nine months. Sixteen years ago he commenced business as a dyer, with his two brothers, he having a capital of about £3,000. Eight years later they dissolved, and, coming out with his £3,000, he continued the Bowling Dyke Works, taking in as a partner Samuel Arthur Farrar. That concern did not answer, and after about two years he (the debtor) retired without a penny, his capital having been lost in the business. When he took up the electrical business, he was joined by Patrick Jas. Charles, who, however, retired from the partnership shortly before his (Mr. Hanson's) failure. The valuation of the stock and plant was made by two valuers, and was taken as a going concern, and on the basis of that valuation, without allowing anything for patent rights, showed a surplus of assets over liabilities. He considered he was at no time prior to filing his petition actually insolvent. What led to his failure was that some time ago overtures were made to himself and his partner, by Messrs. Fowler, of Leeds, to take over their business at North Bridge, and arrangements were made for both himself and Mr. Charles to enter the employ of the Leeds firm, salaries and other matters having been arranged. In view of this, fresh orders were not sought by the debtor and his partner, who merely aimed at completing work on hand. Those negotiations, however, fell through, and afterwards they were not able to make headway. A company was floated with a view to take over the concern, but sufficient shares were not taken up, and he was obliged to file his petition. Mr. England remarked that the books had been well kept. The debtor further added that his personal expenses had been about £3 a week. Mr. Evans said the trustee was thoroughly satisfied with the conduct of the bankrupt, who had disclosed everything; and the books were well kept. The committee of inspection were also thoroughly satisfied. The Registrar: I am quite satisfied, too. Mr. Farrar said a company had been formed since the failure, which had bought the concern from the trustee and was working it. Mr. England said that, valuing the estate as a going concern, the debtor was no doubt solvent at the time of filing his petition. The examination was then closed.

Lightning Burning up Electric Lamps. — The Heisler system of electric lighting about which our New York namesake so recently raved, appears to possess exceptional facilities for inviting disaster. We read that during a thunderstorm in Wabash, Ind., lightning struck the circuit and burned out half the lamps. In the Heisler system all the incandescent lamps are placed in series as in the Bernstein arrangement, but we believe that no instance is known of such an accident occurring with lamps placed in simple multiple arc.

No Electric Tramway for the Isle of Man.—The Tynwald Court decided last week that Ramsay requires an additional landing berth at its pier, and not an electrical tramway as had been suggested.

Obituary.—Lord Alfred Paget, a director of the Eastern Telegraph Company and the Telegraph Construction and Maintenance Company, died whilst on board his yacht in a Scottish canal last week.

Mica Foil.—We understand that Mr. Killingworth Hedges is giving notice to all users of mica foil, or foil "supported by a non-combustible material," that his patents, and that of Mr. H. Edmunds, are being infringed. There are, it is said, several firms manufacturing Mr. Hedges's apparatus without his permission or license.

The Influence of Electricity on the Human Organism.—Dr. Schliep, who is well known as a specialist on the Continent, is just now delivering a series of most interesting lectures on his researches as to the influence of atmospheric electricity on the human organism, on its functions, its state of health or disease. It is well known that the electrical state of the atmosphere has a certain influence on the phenomena of life, but the action of positive electricity and of negative electricity on these phenomena has not yet been determined. Now, according to Dr. Schliep, in supposing the earth charged negatively, an atmosphere charged with positive electricity would act as a stimulant on the human organism, while that with a negative charge would have an enervating effect. Positive atmospheric electricity would favour organic exchanges, oxidation, the circulation, the secretions. But in order that its influence might be salutary, it would be necessary that it should be in a certain affinity with the nervous excitability of the individual. An excessive positive tension would produce a state of insomnia, neuralgia, megrims, and even of inflammatory affections. Negative atmospheric electricity would retard the exchanges and would superinduce fatigue, the interruption of the secretions, congestion, apoplexy, &c. As far as plants are concerned, on the contrary, their mutation would be favoured by a negative atmospheric organisation. The vegetable germs and microbes floating in the air would tend to develop when the atmospheric electricity was negative, and a year in which the days in which this condition was realised predominated, would be favourable to the development of epidemic diseases. It is well known that on stormy days milk goes sour, organic substances decompose, and bad odours are more noticeable than in normal weather. These phenomena are explainable by the influence of negative atmospheric electricity. With a positive electricity, light, heat, and humidity could only have these effects in a modified degree. In conclusion, Dr. Schliep believes that atmospheric electricity has an important effect on the action of the organism and on the therapeutic properties of the air.

A New Miners' Electric Lamp.—Last week at the Cardiff Exchange a number of colliery owners and managers, and others interested in the working of mines, inspected, with much interest, a new safety electric lamp for the use of miners, the invention of Mr. J. P. Rees, electrical engineer, Trinity Street, Swansea. It will be seen by reference to the next column that a company has been formed to introduce Mr. Rees's lamp. According to the description in the local papers, "the body of the lamp is composed of a vulcanite case, measuring 5¼ inches by 5 inches by 3 inches. To the lid is attached a small brass cylinder, and on this cylinder is placed an elongated glass dome, ⅛th inch thick. In the vulcanite case are four cells in separate compartments, containing a supply of carbon in porous pots, which is connected with zinc in the next compartment by means of a short brass pin, with screws at each end, and placed above the surface of the diluted sulphuric acid, with which a series of cells are filled, the porous pots being filled with a liquid prepared by the inventor. Within the lid is a flat piece of India-rubber covered with paraffin wax, and which prevents the liquids from mixing together or shedding whilst being carried. Inside a glass dome at the top is a bulb with an incandescent lamp, and the space between the bulb and the dome is filled with compressed air, forced from a small hand-pump through a tube, and prevented from escaping by means of a screw. This compressed air forces the bottom of the brass cylinder down, and thus, by the inventor's ingenuity, the circuit is completed. The compressed air may be left in for an indefinite time, and the circuit broken by opening the lid alone. It requires great force to break the glass dome; but should it at any time be broken in the course of working, the circuit would be broken at the same time and the light extinguished before the bulb could possibly break, so that its safety would not even then be diminished, nor can it be tampered with without being extinguished. The light given in the first instance is of 3 candle-power; but by means of a number of lenses it is magnified to eight times its intensity. The cost of the lamp is less than 30s., and it can be maintained for 10 hours at a cost of 1d."

Moths Attracted by the Electric Light.—Mr. Thomas Latham, writing to the *Scientific American*, says:—"A curious and interesting spectacle is now presenting itself upon Third Avenue, New York. Myriads of moths are circulating around the electric lamps upon the corners of the street, their shadows being projected upon the sidewalks and opposite blank walls, as if upon the screen of a magic lantern. Passers-by are startled at perceiving these apparitions dart across their path, and stand gazing astonished at the novel sight. The moths are barely a half-inch long, but appear projected at least two feet, with outstretched wings in proportion."

Intercepting Telegrams.—The Austrian War Office is stated to be paying great attention to a matter which is of the greatest importance in the use of the telegraph in the field. It has been ascertained that the telephone is so acute of hearing that before it every secrecy of telegraphing disappears. If, formerly, it was desired to ascertain the secrets of the telegraph wire, the latter had to be cut and an apparatus inserted. Now, with the help of the telephone, all telegrams may be read easily, even from a considerable distance. This would, of course, be very awkward in the case of war telegrams. To solve the problem Herr Heinrich Discher proposes cross-telegraphing. He says that, if telegrams are sent from opposite directions on the same wire at the same time, the listener at the telephone only hears a medley of confused sounds. In practice the matter may be dealt with in the following manner:—One station sends actual telegrams, the other a despatch previously agreed upon. As long as the operator at the former station sees this despatch coming in, he may make sure that no eavesdropper is able to read the telegrams he is sending.

West African Telegraph Company, Limited.—The half year's interest, due September 1st, upon the 5 per cent. debentures, will be paid at the National Bank of Scotland, Nicholas Lane, on and after that date.

NEW COMPANIES REGISTERED.

Bedford Electric Light Company, Limited.—Capital, £15,000 in £1 shares. Objects:—To enter into contracts for electric lighting and for the supply of electric energy for power or transmission. Signatories (with 1 share each), Sir H. C. Mance, Bedford; L. Jessop, Bedford; R. B. Stafford, Bedford; W. B. Jessop, Bedford; O. F. Christie, Hoddesden, Herts; T. Spencer, Ashburnham, Bedford; D. Bower, Springfield House, near Bedford. The signatories are to appoint the first directors; qualification, 100 shares; remuneration, £250 per annum, to be divided as they may think fit. Registered August 29th, by R. Jorden, law stationer, 120, Chancery Lane.

"Rees" Miners' Patent Safety Electric Lamp Company, Limited.—Capital £50,000, in £5 shares, 50 of which are founders' shares, and will entitle the holders thereof to one moiety of the net profits remaining after payment of 10 per cent. dividend upon the ordinary shares. Objects: To acquire under an agreement between John Price Rees and Thomas M. Field, the patent rights for the United Kingdon and elsewhere, of the "Rees Miners' Patent Safety Lamp" and the "Rees Double Liquid Primary Battery," to carry on the business of electricians, electrical engineers, and works and dealers in electrical motive power and light; to create, produce, store and accumulate electricity, electrical motive force or similar agency, and to use and apply the same for the production, transmission or use of power for lighting, heating, signalling, telegraphic, telephonic,

electro-plating, metallurgic, or other manufacturing processes or otherwise. Signatories (with 1 share each), G. Holdworth, Cremorne Wharf, Chelsea; T. M. Field, 41, Earl's Court Square; Henri Gerard, C.E., 31, Crondace Road, Fulham; J. P. Rees (electrician), 1, Trinity Place, Southwark; J. D. Ayres, 6, Old Jewry; T. Baker, 422, Mansion House Chambers; G. S. Anderson, 52, Queen Victoria Street. The signatories are to appoint the first directors. Qualification, £500 in shares or stock. Remuneration of directors, £1,000 per annum. Registered 25th August by W. Vaughan Williams, 16, Craven Street. Registered office, 8, Old Jewry.

Barnet and District Electric Supply Company, Limited.—Capital, £5,000 divided into 490 shares of £10 each and 100 founders' shares, the latter to be entitled to one-half of the surplus profits remaining after payment of 7½ per cent. dividend upon the ordinary shares. Objects: To acquire the benefits and advantages of Mr. H. F. Joel under a contract with the Barnet Local Board for the lighting of the district of the board by electricity, and the supply of electricity to shops, private houses, and other buildings. Signatories (with 10 shares each) *John Ross, 1, Basinghall Street; W. MacNish Porter, Potter's Bar; N. J. Ewart, 46, Langridge Road, S.W.; *J. Palmer, jun., 50, Finsbury Square; *H. F. Joel (electrical engineer), 31, Wilson Street, E.C.; W. Mossop, Byculiah Park, Enfield; A. Morley (electrical engineer), 1, Rocliffe Street, Islington. The signatories denoted by an asterisk are the first directors, and Mr. Joel is appointed managing director; qualification, £100 in ordinary shares; remuneration, £10 per annum each, with £50 additional to the managing director. They may also divide a sum equivalent to 10 per cent. upon the amount of annual dividends. Registered August 25th by Ingledew, Ince and Colt, St. Benet Chambers, Fenchurch Street. Registered office, 31, Wilson Street, Finsbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Medical Battery Company, Limited.—The annual return of this company, made up to the 18th August, was filed on the 20th. The nominal capital is £100,000 in 20,000 shares of £5 each, the whole of which are taken up. 18,800 of the shares are considered as fully paid up, and on the remaining shares the full amount has been called and paid, the calls paid thus being £6,000. The largest shareholders are:—Clara J. Harness, of Clee House, Lavender Hill, whose holding is 7,641 shares, Cornelius B. Harness, of 52, Oxford Street (electrician), whose present holding is 2,345 shares, but who disposed of 2,192 shares on December 30th, 1887, 1,990 shares on December 31st, and 1,197 shares on January 16th, 1888; H. Barrett, of Menival, North Dulwich, 3,705 shares; C. J. Elers, of 87, Wandsworth Road, 2,856 shares; G. F. Wills, Crewkerne, 1,391 shares. Mr. C. Harness, the managing director, formerly held 13,566 shares.

Julien Electric Company, Limited.—The statutory return of this company, made up to the 16th August, was filed on the 22nd August. The nominal capital is £100,000 in £10 shares. 7,307 shares are allotted, and are considered to be fully paid. Registered office, 63, Finsbury Pavement.

Institute of Medical Electricity, Limited.—The registered office of this company has been removed to 24A, Regent Street.

Woodhouse and Rawson, Limited.—An agreement of 28th July, 1887, filed on the 24th August, 1888, relates to the purchase by the company of the business of contractors for the installation of the electric light carried on by the firm of Woodhouse, Rawson & Co. The consideration for the patents and property sold is £54,600, payable as to £34,500, by the issue of 6,000 ordinary shares fully paid, £100 in fully paid founders' shares and £20,000 in cash. This agreement is confirmed by an agreement of 9th August, 1887, and filed on the 24th August, 1888.

An agreement of 13th July, 1888, filed on the 24th August, between Ralph Archbould, C.E., the administrator of the estate and effects of Otway Edward Woodhouse, late of 11, Queen Victoria Street, deceased, of the first part; F. L. Rawson, of 11, Queen Victoria Street, of the second part, and the company of the third part, is supplemental to the above-mentioned agreements. It is agreed that for the purposes of stamp duty the purchase money payable under the principal agreement and supplemental agreement No. I. shall be as follows:—For the English patents, the Foreign, Indian and Colonial patents; for the goodwill of Woodhouse and Rawson; for the goodwill of Woodhouse, Rawson & Co., £100 in founders' shares; for the book debts and stock in trade, £20,000; for the shares in Woodhouse and Rawson Electrical Manufacturing Company, Limited, £22,500; for the shares in Woodhouse and Rawson Electrical Supply Company, Limited, £9,660; for the shares in Woodhouse and Rawson Electrical Contract and Maintenance Company, Limited, £2,340.

ON THE INSTALLATION, COST OF WORKING, AND RETURNS OF CENTRAL STATIONS FOR ELECTRIC LIGHTING.

By W. FRITSCHE (of the firm of Fritsche and Pischon, Berlin).

(*Concluded from page* 642, *Vol. XXII.*)

THE consumption of light at present existing and to be expected in the future is given, and representations of the fluctuations of consumption of each month are given by tables and diagrams.

The diagrams do not show the absolute consumption in volt-amperes, but percentages of the maximum; so that for each maximum to be expected in succeeding years the daily consumption may be at once ascertained.

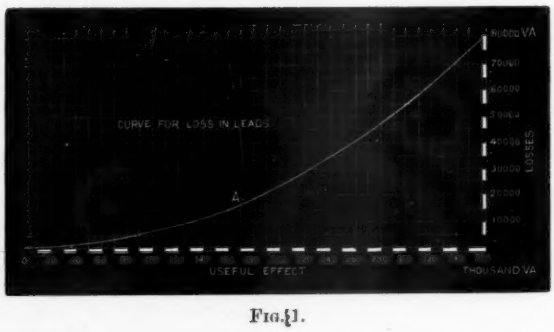


FIG. 1.

It is supposed as a preliminary that the consumption of light will be only one-third of the maximum for which the conductive net is adapted, *i.e.*, 120,000 v.a., and the boilers, motors, and dynamos are planned only for this yield.

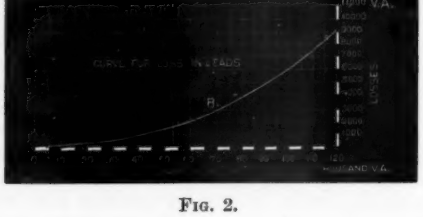


FIG. 2.

This case may occur in all such installations, so that the subjoined calculation of returns, though it has been carried out only for this special case, has a more general meaning.

The first question is arranging the dimensions of the net of wire. A wire net, which in consequence of the heavy price of copper, the careful insulation required and the expense of fixing, &c., represents a large capital, can be arranged only after careful examination and knowledge of the existing requirements and how they may be met at the smallest expense.

The basis of the entire project must be a comprehensive statistical enquiry into the consumption of light in the district to be supplied.

The results are necessary for the disposal of the net of wires, and for the boilers, motors and dynamos.

In projecting a central station it is necessary to know not merely the demand for light in bare figures, *i.e.*, the number of glow lamps and arc lights of some given strength, but further to construct a scheme as accurate as possible of the fluctuations of consumption during the 24 hours of the day at different seasons of the year. This requirement is met by the diagrams, figs. 6 to 17. The data derived by these diagrams in conjunction with an account of the extent of the district and the grouping of the lamps furnish the starting points for determining the wire net.

From these data may be ascertained the economical sections of the wires after determining the loss which is permissible in the conductors, calculated in per cents. on the maximum useful effect. The sections of the distributing wires are determined by the extent of the net, especially by the distance of the nodal points and by the number of lamps to be connected. It is essential that from one nodal point to the nearest of a different polarity there must occur only a certain decrease of tension (1 to $1\frac{1}{2}$ v.)

The number of nodal points depends in part on local circumstances, *e.g.*, by the accumulation of large groups of lamps at certain points (such as on account of a theatre), but in part on the question of returns which decides on the number and the sections of the conductors.

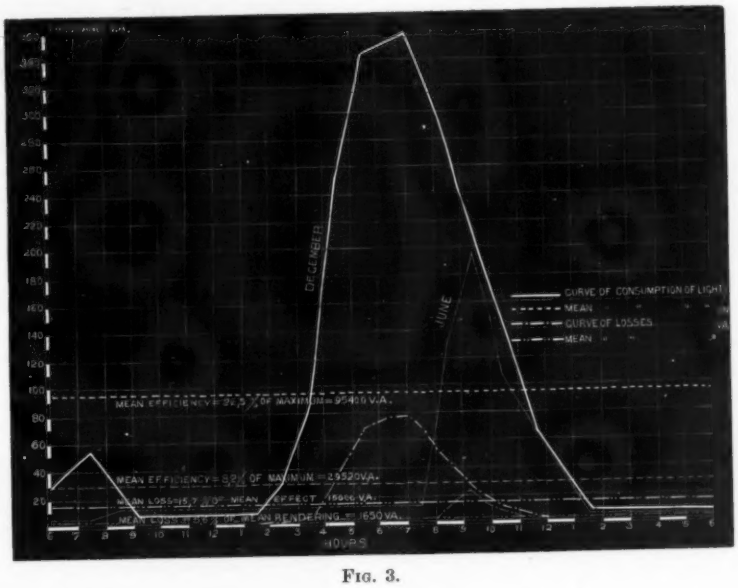


FIG. 3.

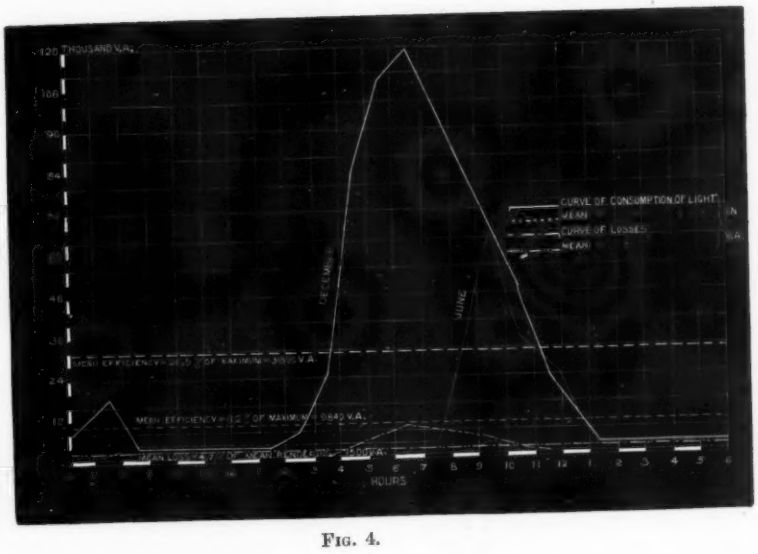


FIG. 4.

In general, the number of the conductors must increase with the magnitude of the maximum consumption of the current, but this is not the case with the sections. For the sections of the conductors the permissible decrease of tension must decide, which again depends directly on the mean consumption of the current.

Instead of aiming at a very small loss of tension and consequently selecting large sections, corresponding to a temporary maximum consumption of current, the permissible loss and therewith the section of the conductor must always be determined according to a mean consumption of current, so that there occurs in the con-

ductors sometimes a larger, sometimes a smaller loss of tension, but always a mean economical loss.

These principles have been kept in view in the present special case as follows :—

The distributing conductor is connected with the central station by a sufficient number of positive and negative wires, giving a completely suitable distribution of 360,000 v.a.

The choice of the number of conductors and the determination of their sections are found in accordance with the mean yearly consumption of light to be expected, the mean loss of tension in the conductors being so determined that the increased working cost thence arising is not important, and on the other hand, so that the capital sunk shall not be too heavy, as would occur with a very small loss of tension on account of the large section (see Table to follow).

From the diagrams drawn out for the 12 months, we find the mean consumption for each month, and then the mean yearly consumption, which is 16·375 per cent. of the maximum consumption.

On the average, therefore, there are consumed 16·375 per cent. of the 360,000 maximum useful result, or 58,932 v.a. The average loss must correspond to this average value if the installation and the working are to be economical. The total loss of tension in the afferent and distributive conductions for the mean result is assumed at 3·5 per cent. of the useful tension. As we shall subsequently see from the calculation of returns, there appears a very satisfactory unit-price per lamp and per hour, a proof that by this percentage the capital and the working cost have been taken into due consideration.

To make manifest the losses which appear during all the occurring fluctuations of consumption, and on the assumption that at 16·375 per cent. of 360,000 v.a. or 58,932 v.a. the loss of tension is 3·5 per cent., the corresponding loss in volt-ampères has been ascertained at various degrees of useful action, and the curve, A (fig. 1), has been drawn. For all the useful effects (from 1 to 360,000 v.a.) which are plotted out as abscissæ, the ordinates give the corresponding losses in volt ampères. It is seen that at the highest demand there is a loss of energy of 37,400 v.a., or about 21·5 per cent.

This loss is so distributed in arranging the dimensions of the sections of the conductors, that 20 per cent. of the useful work is lost in the afferent conductors and in the distributors 1·5 per cent., or if we take 100 v. as the useful tension at the lamps 20 v. and 1·5 v.

For the expected maximum effect of 120,000 v.a. there results the mean effect per hour's burning throughout the year of 16·375 per cent., or 19,650 v.a., and to this mean efficiency there corresponds for the sections chosen the very small mean loss of tension of 1·17 per cent.

For this case the curve of loss, B, has been drawn on a larger scale in fig. 2, from which may be learnt the varying loss in volt-ampères for the different strengths of current.

By means of these two curves, A and B, we can easily construct, for both cases (one where the maximum consumption of light is 360,000 v.a., and the other were it is only 120,000 v.a.) the fluctuating losses corresponding to the fluctuations of the current, as we will show in detail for December and June.

In fig. 3 the consumption of light in v.a. for December and June is plotted out on the axis of the ordinates as it occurs at the different hours shown as abscissæ. From the calculation of the surface the mean consumption is found to be 26·5 per cent. of the maximum 95,400 v.a., and this mean performance is shown as a dotted line parallel to the axis of the abscissæ. The curve indicated by little strokes represents the loss of conduction ascertained from the curve, A (fig. 1), and the mean loss of energy in v.a. for December is also shown by a corresponding line of little strokes. The mean loss in December is naturally larger than the mean yearly loss, and it is calculated from the diagram as 15·7 per cent. of the mean work in this month. For June, in which there is the smallest consumption of light and the smallest loss of conduction, the mean loss is only 5·6 per cent of the mean consumption of light.

For a probable maximum of 120,000 v.a. the losses of conduction will naturally be but small. By means of the curve, B, we can construct these losses accurately for the months December and June.

The mean loss in conduction in volt-ampères for December is in this case 4·71 per cent. on the mean production, but in June only 2·02 per cent. In fig. 4 the parallels of the axis of the abscissæ showing the mean loss for June cannot be shown, as the scale could not be made large enough. The curves of loss are therefore given only partially in figs. 3 and 4.

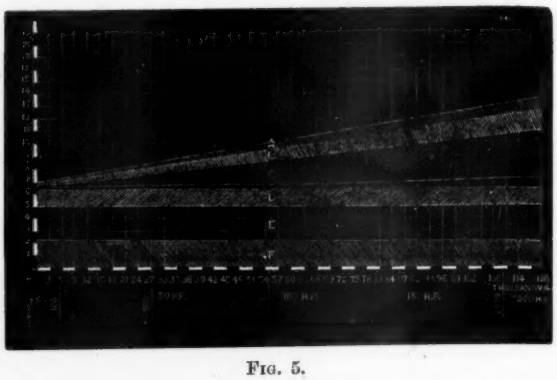


FIG. 5.

A, Various small repairs. B, Oil consumed when running empty and useful effect. C, Coke consumption for useful effect. D, Management. E, Depreciation and repairs. F, Interest. The above diagram represents an installation of 100 to 2,000 glow lamps of 16 candle-power. The coke consumption when running empty shown by C_1.

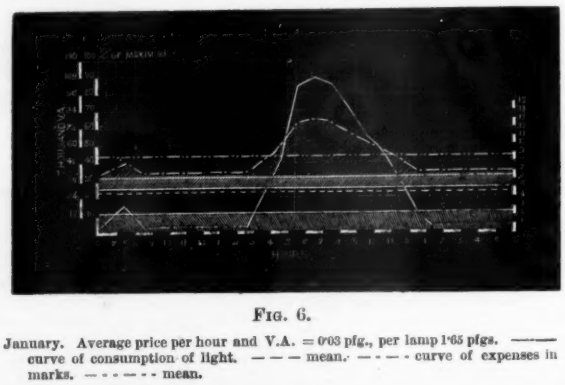


FIG. 6.

January. Average price per hour and V.A. = 0·03 pfg., per lamp 1·65 pfgs. ——— curve of consumption of light. — — — mean. — · — · curve of expenses in marks. - - - - - - mean.

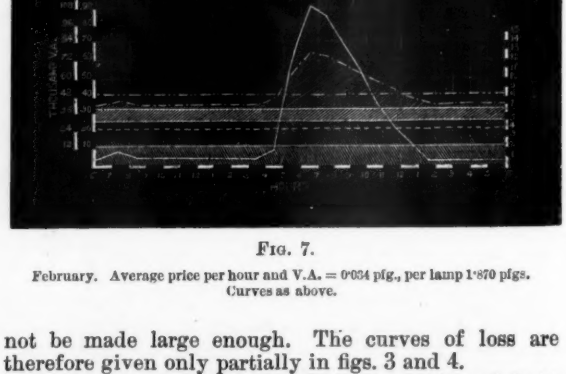


FIG. 7.

February. Average price per hour and V.A. = 0·034 pfg., per lamp 1·870 pfgs. Curves as above.

The statistical results as to the consumption of light give indications not merely for the net of conducting wires, but for the boilers, the motors and the dynamos.

It has been already mentioned that the machinery is calculated only for one-third of the useful work for which the conduction is estimated.

It has been found that in summer the consumption of light is not half that of the winter months. In December it reaches 26·5 per cent. of the maximum, but in June only 8·2 per cent.

The machinery is therefore adapted to a maximum of 120,000 v.a., bearing in mind the circumstance that the mean yearly production is only 16·375 per cent. on the maximum, or 19,650 v.a.

There are consequently required three safety tube steam boilers, each having 100 square metres of heating surface, and two compound engines which can give a maximum of 90 to 150 horse-power. As such a power is demanded only transitorily, the engines must work rationally at a lower mean yield, but be powerful enough for the maximum, if required. Two engines are selected to meet the demand for working both by day and late at night.

After this brief description of the installation we may pass on to ascertain the cost of working and to calculate the returns.

The total costs consist of these main items :—

1. Interest on capital.
2. Paying off capital and repairs.
3. Working costs.

By working costs we understand :—

a. Expense of management.

b. Fuel, oil, small repairs and sundries.

The total capital required for a central station of the extent described amounts, under the most unfavourable conditions, high prices for copper, &c., but exclusive of building ground, to £23,500, divided as follows :—

	£
Building	750
Steam engines	1,495
Boilers	1,675
Wells and drains	1,000
Dynamos	865
Apparatus	335
Wire conductors	17,450
	£23,000

The rent on this capital at 4 per cent. is £940.

This yearly interest, distributed over 24 × 365 = 8,760 hours, comes to 2·14s. hourly.

This amount is plotted out as an ordinate in a rectangular system of co-ordinates on the axis of the abscissæ of which the useful effect in volt-ampères (or their equivalents in lamps or in horse-power) are plotted out. The interest is to be calculated independently of the number of lamps burning simultaneously, giving thus a parallel to the axis of the abscissæ.

For paying of the original cost and for repairs we have the following :—

	£	£	s.
Buildings, 2 per cent on ...	750	= 15	0
Steam engines, 5 per cent. on	1,495	= 746	5
Boilers, 10 per cent. on ...	1,675	= 160	15
Wells, &c., 5 per cent on ...	1,000	= 50	0
Dynamos, 5 per cent. on ...	865	= 43	5
Apparatus, 10 per cent. on ...	335	= 33	10
Wires, 5 per cent. on	17,450	= 872	10
	£12,496		5

These yearly charges represent an hourly expenditure of 2·85s., which we also plot out as an ordinate, and obtain thus a second parallel to the axis of the abscissæ.

The cost of management consist of the following items :—

	£
1. Manager's salary	150
2. Engineer	100
3. Two firemen	120
4. Superintendent of conductors	120
5. Regulator	75
6. Office expenses	60

This yearly cost represents an hourly expenditure of 1·42s.

We have therefore a constant hourly cost, whether much or little light is required, of 6·41s.

The expenses which vary with the number of lamps are :

Coal or coke ;
Oil and cotton waste ;
Sundries and small repairs.

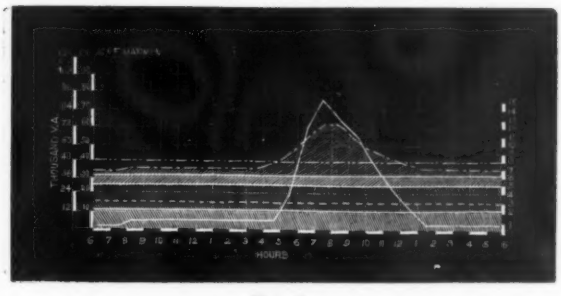


FIG. 8.

March. Average price per hour and V.A. = 0·043 pfg., per lamp 2·365 pfgs. Curves as above.

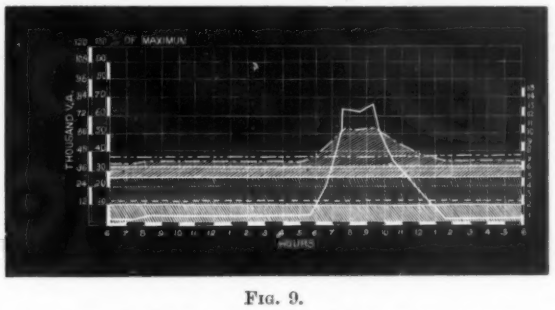


FIG. 9.

April. Average price per hour and V.A. = 0·065 pfg., per lamp 2·75 pfgs. Curves as above.

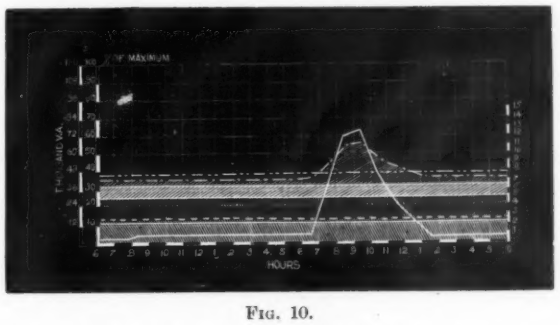


FIG. 10.

May. Average price per hour and V.A. = 0·055 pfg., per lamp 3·025 pfgs. Curves as above.

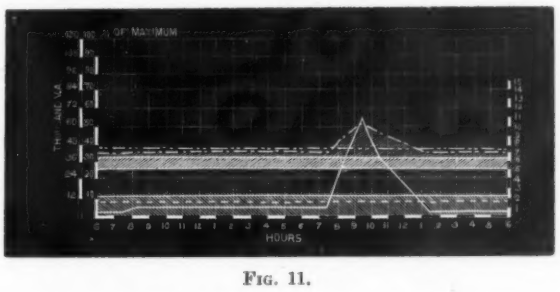


FIG. 11.

June. Average price per hour and V.A. = 0·075 pfg., per lamp 4·125 pfgs. Curves as above

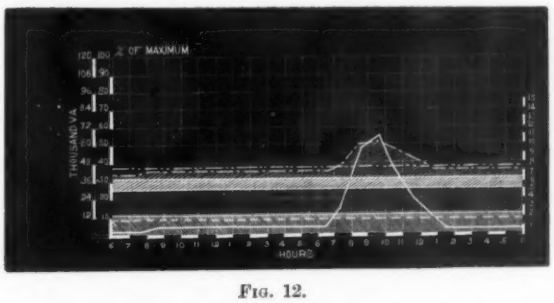


FIG. 12.

July. Average price per hour and V.A. = 0·065 pfg., per lamp 3·575 pfgs. Curves as above.

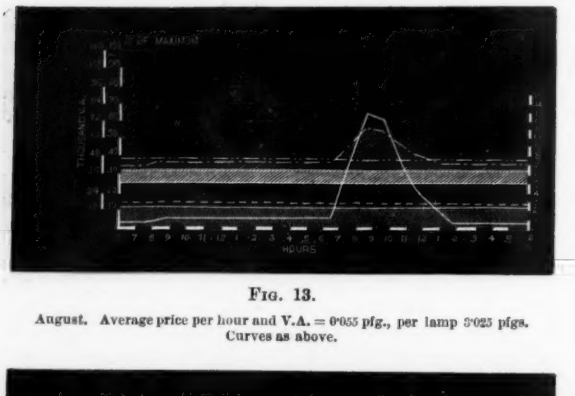


FIG. 13.

August. Average price per hour and V.A. = 0·055 pfg., per lamp 3·025 pfgs. Curves as above.

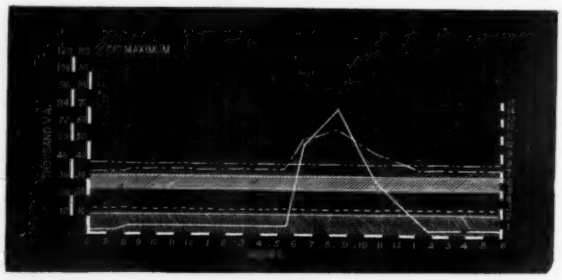


FIG. 14.

September. Average price per hour and V.A. = 0·048 pfg., per lamp 2·640 pfgs. Curves as before.

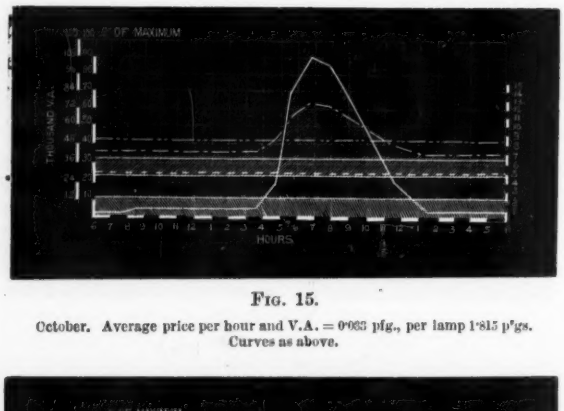


FIG. 15.

October. Average price per hour and V.A. = 0·033 pfg., per lamp 1·815 pfgs. Curves as above.

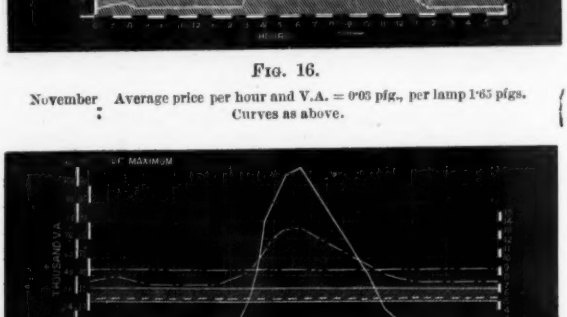


FIG. 16.

November. Average price per hour and V.A. = 0·03 pfg., per lamp 1·65 pfgs. Curves as above.

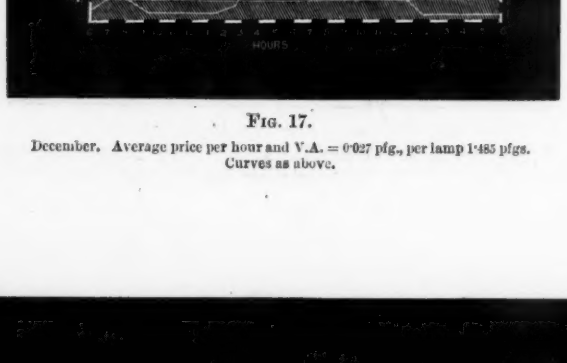


FIG. 17.

December. Average price per hour and V.A. = 0·027 pfg., per lamp 1·485 pfgs. Curves as above.

In determining the ordinates in the diagram, fig. 4, which shows the fluctuating outlay for fuel, the mechanical work required for the production of the useful effect is noted on the axis of the abscissæ. These ordinates hold good for the total gross expenditure, including loss in the conductors.

To ascertain the consumption of steam and the corresponding cost of fuel, the following assumptions are taken as a foundation :—

The consumption of steam per hour horse-power amounts to 10 kilogrammes, the evaporative power of the coke is taken as sevenfold, 7 kilogrammes of steam =1 kilogramme of coke. The price of 1,000 kilogrammes of coke is 13s. The determination of the cost in the several months and in the whole year, regard being had to all the daily fluctuations, is obtained from the above-described diagram and the graphic representations of the fluctuations of the light in the twelve figures 6—17.

As we can take from diagram, fig. 5, the total expenditure for the different volt-ampères from 1 to 120,000, we are in a position, in accordance with the curves for the varying daily consumption, to construct the corresponding cost.

This has been carried out for all the twelve months in the diagrams Nos. 6 to 17. From the curves of expense appear, further, the mean figure which must be expended daily in order to suit the fluctuating consumption. Finally, we can easily find, in accordance with the mean hourly consumption for the year, a mean yearly cost per hour.

As the notes to the various diagrams and the subjoined tabular conspectus show the average price per voltmeter and per hour, or per lamp (16 normal candles) and per hour, can be found for each month from the graphic constructions. Fifty-five v.a. electric energy are taken as requisite for a 16-candle lamp. Further the diagrams show the number of hours in which the lamps are required to burn in each month and the yearly total.

MAXIMUM OF THE USEFUL WORK EXPENDED IN CONDUCTIVE NET : 120,000 V.A.

	Percentages of the maximum.	Mean result.	Mean Hourly Price.			Hours burning. per month.
			Mean price in shillings.	Mean price per v.a. in pfennige.	Mean price per lamp in pfennige.	
January...	23	27,600	8·5	0·03	1·65	171·12
February	20	24,000	8·3	0·034	1·870	134·40
March ...	15·5	18,600	8·0	0·043	2·365	115·32
April ...	12·8	15,360	7·8	0·05	2·75	92·16
May ...	11·5	13,800	7·6	0·055	2·025	85·56
June ...	8·2	9,840	7·4	0·075	4·125	59·04
July ...	9·5	11,400	7·5	0·065	3·575	70·68
August ...	11·5	13,800	7·6	0·055	3·025	85·56
September	13·5	16,200	7·9	0·048	2·640	97·20
October ...	20·5	24,600	8·3	0·033	1·815	152·52
November	24	28,800	8·6	0·03	1·65	172·80
December	26·5	31,800	8·65	0·027	1·485	197·16
Mean	16,375	19,650	8·12	0·0461	2·54	1433·72 Yearly total hours.

(N.B.—The "pfennige" is the $\frac{1}{100}$th of a shilling.)

The annual yearly price per v.a. and per hour is therefore 0·0461 pfennige, or per glow lamp at 16 normal candles, 2·54 pfennige. Thus we have all the data for ascertaining the total yearly cost.

Under the above conditions there appears (see Table) for every hour in the year a mean expenditure of 8·12s., or a total yearly outlay of $8{\cdot}12 \times 24 \times 365 =$ £3,556 $1\frac{1}{10}$s., for which these are supplied in volt-ampère hours

$$19{,}650 \times 24 \times 365 = 172{,}134{,}000 \text{ v.a. hours.}$$

If every hour that a lamp burns is paid for at 4 pfennige (0·04 shilling) which corresponds to a price of 0·072 pfennige per v.a. hour, the gross returns will be £6,196 16s. 6d. There is, therefore, an overplus of £2,640 15s.

As interest of 4 per cent. has already been allowed upon the capital, this overplus corresponds to a dividend of 11·23 per cent. Hence the result may be regarded as satisfactory, and a considerable discount may be allowed to consumers without interfering with the remunerative character of the undertaking.

The conditions will appear more favourable when the installation is completed to its full extent and the machinery acts according to the maximum consumption of light for which the conductive net is calculated, the whole being thus more completely utilised.

For such a case, which must occur sooner or later, the sale price per lamp hour can be considerably reduced.

The above data and figures are all so thoroughly established that it will be easy for the specialist to exert his critical powers and to form a judgment as to the present position of electric lighting.

The author hopes that by the publication of the above enquiries he may have met the requirements of persons interested, and shown professional men what course to take in the construction of central lighting stations.

REVIEW.

Dynamo-Electric Machinery. By SILVANUS P. THOMPSON, D.Sc., B.A. (Third Edition.) E. and F. N. Spon: London, 1888.

When we reviewed the second edition of Prof. Thompson's book in the beginning of 1886, we had occasion to point out several inaccuracies of a theoretical character, and to condemn the algebraic theory of the dynamo therein developed. We are pleased to notice that in the third edition now before us most of the matter of which we complained has been expunged, the volume being in consequence a great improvement upon the former edition.

In two years much has been done. Previous to the appearance of the 1885 edition some attempt had been made to connect the magnetising forces with the magnetism produced in dynamos, but at the time of our notice we had to express regret that the data to hand were not sufficiently complete for practical purposes. That dynamo makers would have been glad of exact information on this point was then apparent; now, thanks to the labours of the Hopkinsons, we are in possession of full particulars; we can draw the curves of magnetisation in a way directly applicable to the construction of machines, and we become quite independent of Müller, Dub, Frölich, Kapp, and all the host of experimenters who have from time to time added their tribute to the existing mass of empirical formulæ. Prof. Thompson, in this edition, has simplified the theory, and curtailed, to a large extent, the mathematical parts of the work. He has combined the graphic and algebraic methods of treatment, having rewritten nearly the whole of the book, and added much new matter.

The first chapter is devoted to an introductory portion, to historical notes, and to definitions of electrical units, the physical theory of the dynamo being given in the second chapter. Chapter III. treats of the organs of dynamos, and the author tells us here that in constant potential machines the iron in the armature ought to be magnetised to about 16,000 C.G.S. lines per square centimetre. On page 48 he says, to avoid eddy currents, heavy armature conductors should be slit longitudinally. Of course, slitting does not prevent eddy currents if the ends of the several divisions into which the conductors are cleft remain joined; the only way to prevent eddy currents being to insulate the several parts and strand them together, or to adopt some equivalent measure. We notice that in this chapter a number of corrections, which we formerly suggested, have been made. The advice to employ long magnets has been struck out, and in accordance with modern ideas, we are told to make the magnetic circuit as short as is consistent with providing room for the necessary exciting coils. Instead of winding the turns on the middle of the magnet, we are informed that they should be wound nearly uniformly along the whole iron circuit. But we are still told that in the case of a collector made of parallel bars of copper, the bars should be removable singly for repairs and examination. In 1885 we might have admitted this, but certainly not now. We know of very few machines worthy the name which have collectors with removable bars, though the commutators of open coil machines are often made with movable segments.

We have grave doubts regarding the wisdom of repeating in this edition the induction experiments of Isenbeck. Of what earthly use to demonstrate anything in connection with modern dynamos is the antiquated piece of apparatus shown in figs. 42 and 45? The distribution of the field is absurd, and the curves and description filling ten pages fulfil, to our way of thinking, no useful purpose. Nor does the apparatus in fig. 53 strike us as being of modern build. It is true the Gramme pattern of armature, as compared with the Pacinotti pattern, may be a retrograde step, "always supposing that the cost of construction, liability to heating, and other kindred matters be equal for the two." But it is just the want of equality in these things which should guide us in striking a balance; and, on the whole, it is extremely doubtful, when all is weighed up, whether there is between the two classes an atom of advantage or disadvantage.

In Chapter V., dealing with reactions in the armature and magnetic field, Prof. Thompson, if we understand him aright, attributes to the cross-magnetisation of the armature core the weakening of the field. We believe this is incorrect. The weakening of the field is due not to cross-magnetisation, but to the demagnetising effect of conductors on the armature covering an arc equal to four times the angle of a lead given on account of cross-magnetisation. It is quite likely that the author means this; if so it is not very clear, and the experiments of Strömberg on the subject are not detailed with sufficient accuracy. The remarks made on page 108 we cannot understand. Prof. Thompson there says that when a Gramme machine has been running for some time the edges of the pole-pieces which the armature leaves get hot while the others remain cool; and this he attributes to eddy currents generated in the poles by the drag of the armature. Now, why? Eddy currents can only be due to a change in the distribution of magnetism on the polar surfaces, and we ask where is the cause to produce such an effect in a smooth core armature gliding through an unchanging field? Probably we shall be laughed at when we suggest, as a solution of the mystery, that the armature sucks in cold air at the edge of the pole-piece which it enters, and carrying it round, throws it out a little hotter, from contact with the conductors, at the edge which it leaves. But alas for the beautiful theory! this is quite true, and gives a simple reason for the leaving edge getting a little hotter than the other.

Chapter VI. treats of the government of dynamos, and in the next chapter is commenced the descriptions of actual machines. The Gramme machine (type supérieur), illustrated in figs. 95 and 96, seems a long way behind British-built dynamos. The reader should observe the relation between the thickness of the copper wire on the armature core and the thickness of the core itself in this machine, comparing it with that, say, in the Crompton dynamo, two pages further on. By-the-way, we rather think that 69 windings of copper ribbon on the armature of the latter dynamo is a mistake for 96. Beside these two, there are described the Kapp, Phœnix, Manchester, McTighe, Oerlikon, Siemens and Halske, Holmes, and Hochhausen machines among the elongated ring class, and the Schuckert, Victoria, and Gülcher machines among the flat ring class. The drum class embraces the Edison, Weston, Siemens, Crompton and Swinburne, Thury, and Goolden machines; while the open coil and unipolar dynamos are described as formerly. The descriptions of alternating current machines are in this edition kept apart from the

descriptions of continuous current machines, and have Chapter XII. all to themselves. Amongst the machines of this class recently constructed, and not described in previous editions, are those of Elwell-Parker, Stanley (Westinghouse), Kennedy, and Mordey.

The part of Chapter XIV., which deals with field magnets and magnetism, is quite new, and includes the theory of the magnetic circuit as developed by Rowland, Hopkinson, Kapp, and others. Prof. Thompson objects strongly to what he calls in Kapp's papers mixed units, and perhaps this is to be expected, as the professional methods of dealing with problems are rarely similar to those adopted by constructors in the workshops. Centimetres, seconds and dynes are very well for the laboratory, but in the factory we use rules divided in inches, we are more familiar with the measurement of time in minutes, and we compute forces in pounds. Since Kapp's papers have been written with a view to simplifying practical calculations, we think the Professor's remarks are needlessly condemnatory, and we are of opinion that his own formulæ might have been of greater value had he expressed them in the language of the workshop. In this chapter the gist of the Hopkinsons' very important paper on the synthesis of the characteristic is given, and several new forms of field magnets adopted by recent makers have been added.

In considering the characteristics of different machines Prof. Thompson does not indicate very clearly the effect of the armature reactions or their exact character. For instance, the E.M.F. generated in a series dynamo is not strictly proportional to the turns on the armature, because a greater number of armature turns implies a greater lead, which means a weakening of the field. Again, the E.M.F. due to an increase in the magnet turns will be greater than the shortening of abscissæ on the characteristic would point to, since the strength of the field will be increased in a greater ratio than the construction shows. This reaction of the armature on the magnets seems to be ignored throughout the treatise, as it was in former editions, and we confess our disappointment was great when we found this to be the case, especially as the author, in mentioning in the beginning of the book the experiments of Strömberg, had led us to believe that this point would be duly considered. For a starting point the author might have referred to the paper of the Hopkinsons, where there is to be found a very complete investigation of the weakening of the field, due to the lead of the brushes in drum armatures. But all that we have on this question is a statement on page 431, to the effect that in compound machines the demagnetising *tendency* must be compensated by additional turns of series wires. Why the method of Hopkinson should be used "to predetermine the constants for the very convenient approximate formulæ of Frölich and of the author" we do not know, and it seems to us to be a roundabout way of doing things. Why employ an approximate formula when truth stares us in the face on a curve? It would be a very simple matter to construct from Hopkinson's experiments a diagram showing the number of ampère turns required per inch length of iron for any particular strength of induction, and having this for constant reference, we fail to see the use of any approximate formulæ, or to imagine how any formulæ can be simpler in application.

The equations for constant potential dynamos have been corrected by introducing permeability coefficients for the range of the shunt windings, and for the range of the combined shunt and series windings; but as regards constant current machines, we can only repeat what we have before said, that the construction of compound constant current machines to be of any use is a physical impossibility. They have been thought out well on paper, but so far as we are aware, one has never been made to work. Other methods of regulation for constant currents which have proved more or less successful in practice are, however, fully described.

Regarding the relation of size to capacity and efficiency, there seems to be considerable difference of opinion. In the last edition it was stated that the output of dynamos increased as the fifth power of the linear dimensions when driven at the same number of revolutions, or we might say as the fourth power of the linear dimensions when the speed is inversely as the linear dimensions. When noticing the edition in question, we had occasion to reject this statement, and remarked that the work was about proportional to the weight, although the efficiency increased with the size. Prof. Thompson gives the statements made by different authorities, though he does not always describe the reasoning process by which they arrived at the particular values they give. Mascart, Joubert and Pescetto give the output as proportional to the *square* of the linear dimensions. Hopkinson and Rechnieuski give it as the *cube*. Kapp gives it as the 3·5 power and Ayrton as the 3·7 power. It is certain that the *square* is too low, but we think it is equally certain that the $3\frac{1}{2}$ power is too high. If we recollect rightly Mr. Kapp, who obtained this value, assumed an advantage from the clearance between the armature and magnets not requiring to be increased in proportion to the linear dimensions. On this assumption, and also because less room proportionally was taken up by the insulating material on the larger machine, he got on his armature an amount of copper proportionally greater than the linear dimensions. He also, for some reason we do not comprehend, imagined that the field density would be greater in the larger machine, and on account of these assumptions the output stated was obtained. Although something can be allowed on account of proportionally diminished clearance and insulating space, the field density must be imagined as similar in the larger machine. Kapp allowed too much, and we think that the *cube* of the linear dimensions expresses nearer than anything else, as regards output, the results of actual practice. If we imagine that the clearance and insulation space were increased as the other dimensions, the output would be as the $\frac{3}{2}$ power of the linear dimensions, as is very easily seen. The field produced is n^2 if the linear dimensions are increased n times. The radiating surface of the armature is also n^2. The section of the armature windings is n^2, and the length being n, the resistance is $\frac{1}{n}$. Since the heat developed must be proportional to the radiating surface, or n^2, the current flowing is n^1. But since the field is n^2, the E.M.F. at $\frac{1}{n}$ of the former speed is n, so we get as the output or product of current and E.M.F., n^3. This is with the clearance increased as the linear dimensions, but in practice this is not requisite, the advantage secured by diminished clearance just being about sufficient to raise the output from n^3 to n^3. Sometimes it may be a little higher, but seldom, we should think, $n^{3\frac{1}{2}}$. It may be remarked here that the cross magnetisation in large machines plays a most important part. The magnetic circuit in a machine of increased size will have a resistance of $\frac{1}{n}$, and since n^2 lines have to be sent through this resistance, the field will require a magnetising force of n ampère turns, ignoring the cross magnetisation. But the ampère turns on the armature are now from n^2 to n^2, and the demagnetising effect will be in the same proportion. It follows that the ratio of the compensating turns on the field to the useful turns increases greatly with the size of the dynamo.

In the chapter on alternating current machines reference is made to the deviation in modern dynamos from the sine curve for the induction, and in the following chapter, relating to the coupling of dynamos, the diagrams have been made somewhat clearer. The chapter on transformers might have been more instructive to beginners if a graphic method of treatment had been incorporated with the formulæ as in dealing with dynamos proper. The dynamo portion of the work concludes with a short note on continuous current transformers.

In the chapter on the theory of electromotive power, several new diagrams have been added and new problems solved, but we do not see amongst them any reference to the question which some time ago occupied the

attention of Ayrton and Perry as to the most economical section to give to a conductor when the voltage is fixed at the generator end, and the power at the motor end of a line. This is a rather important question, and should find a place amongst kindred problems. Amongst the motors not described in previous editions are those of Immisch and Sprague. The author says (page 573) that "a shunt motor supplied at constant potential will have a speed that would be constant and independent of the torque if it were not for internal resistance." It is here assumed that there is no backward displacement of the brushes, but it is a curious fact that with the brushes so displaced, a shunt motor will, owing to the demagnetising effect of the armature current, govern perfectly. We have heard of a motor in which, due to this cause, the speed actually increased with the current. We confess we are not strongly impressed with the necessity for compound motors—Sprague notwithstanding.

A chapter on Testing Dynamos and Motors concludes the main portion of this valuable work, there being, as in former editions, several appendices touching the latest development of theory. We can at the end, after reading through, describe the volume as fulfilling our first impressions. Whether we regard the dynamo from a historical, scientific, or practical point of view, there is in this book much instruction, and we therefore recommend our readers to give away, or sell if they can, their second edition at once and buy the third.

LEGAL.

Fyfe v. Gwynne and Others.—(Chancery Division. August 24th. Before Mr. Justice Denman, sitting as Vacation Judge.)—This was an action brought by Mr. James Fyfe on behalf of himself and all other shareholders of the defendant company other than the remaining defendants against Mr. J. E. A. Gwynne, Sir Rawson W. Rawson, Mr. H. W. Scriven, Mr. G. L. Whateley, and the Pilsen Joel General Electric Light Company, Limited, and the plaintiff claimed that an agreement or alleged agreement for the sale of the undertaking of the defendant company to the defendant Gwynne alleged to have been entered into or adopted at a meeting of shareholders of the defendant company held on the 10th of August, 1888, might be declared to be fraudulent and void and *ultra vires*, and not binding upon the defendant company or the plaintiff or other the shareholders therein. (2) An injunction restraining the defendants Rawson, Scriven, and Whateley, as directors of the said company, from carrying out or proceeding with the said agreement, and the defendant Gwynne from entering into or continuing in possession, disposing of, or otherwise dealing with, the property, assets, or undertaking of the defendant company, or any of them, or any part thereof under or in pursuance of such agreement. (3) A receiver. The plaintiff, Mr. James Fyfe, in his affidavit dated the 18th of August, 1888, said that the defendant Gwynne, an engineer, alleged that he had purchased or agreed to purchase, and the directors alleged that they had sold or agreed to sell to him, the whole of the business property and the entire undertaking of the defendant company as a going concern, with all its assets, for the sum of £4,550. The plaintiff alleged that this price or sum was utterly inadequate, and a greatly enhanced price could be readily obtained by the exercise of ordinary care and diligence. The sale or agreement for sale was not *bonâ fide*, nor was it for the benefit of the general body of shareholders, but it was entered into by the defendant Gwynne while acting in a fiduciary capacity in relation to the shares of the defendant company; also that the shareholders had not had reasonable opportunity of exercising their option as to such sale. According to the plaintiff's case, there were 400 members of the company (which was formed in 1882) holding 22,000 shares originally of £4 each, afterwards reduced to £2, of which £1 8s. was deemed to be paid up. The plaintiff was a holder of 665 shares. On the 27th of June, 1888, at a general meeting of the company a resolution was passed by the shareholders that the directors be instructed to consider the best means of disposing of the property, goodwill, &c., of the company, and Mr. Phillips, Mr. Gwynne, Mr. Parrish, and the plaintiff were appointed a shareholders' committee to act with the directors in arranging and negotiating such sale subject to the consent of the shareholders being obtained before any proposal for the purchase was finally accepted. On the 17th of July, 1888, advertisements were inserted in various papers offering the business of the company for sale by tenders to be received on or before the 25th of July, but no tenders were received. The plaintiff proposed that an attempt should be made privately to get a purchaser. This was opposed by the defendants, and on the 4th of August a lithographed draft of a statement to the shareholders was produced at a committee meeting, recommending the sale by the company to the defendant Gwynne of the whole of the company's undertaking and all its assets for £4,550, with a certain option to holders of 200 shares and upwards of joining in Mr. Gwynne's purchase. On the protest of the plaintiff the number of qualifying shares was reduced to 100. The plaintiff alleged that there were 335 shareholders holding less than 100 shares who would be unfairly treated by the agreement. The plaintiff alleged that the company was perfectly solvent, having recently made a call, which realised £3,315, to discharge liabilities, and that the company was now earning an income of £5,400 a year. On the 2nd August, 1888, notice was given of a meeting on the 10th—(1) to consider the offer of Gwynne; (2) to wind up voluntarily; or (3) in the alternative to call up the balance of 12s., and carry on the business. An explanatory statement was posted on the 4th of August; the 6th of August was Bank Holiday. The notice stated that all proxies must be lodged 48 hours before the meeting. The defendant was the holder of 875 shares, but pending the meeting of the 10th of August, he bought about 3,000 shares, including 1,300 shares belonging to Phillips. The recommendation for sale to Gwynne was signed by Phillips, one of the members of the shareholders' committee, who had sold his shares to Gwynne. On the 10th of August, out of 400 shareholders 13 voted for the resolution and 12 against, and on a poll 6,352 shares voted for and 1,424 against. The defendant Gwynne offered £6,000 if the preferential clause as to holders of 100 shares was omitted; this offer was refused. The directors of the company had received £87,000, and in addition for six years the whole of the earnings of the company. The patents were valued at £25,000, and the plant, stock, and machinery at £10,235. The balance at the bank was £1,500. These figures were disputed by the defendants. Mr. Gwynne paid £3,000 on account of the purchase money, and entered into possession of the business. He said that he had offered as much as the business was worth and had undertaken all the liabilities. The contract was perfectly *bonâ fide* and within the powers of the company. He was not in a fiduciary position at the time of the contract. The case now came on on a motion for an interim injunction.

Mr. W. R. KENNEDY, Q.C., and Mr. POCHIN, for the motion, contended that in point of law the agreement was *ultra vires* and bad. On the balance of convenience matters should be left in *statu quo*.

Mr. MARTEN, Q.C., and Mr. A. D. MACLAREN, for Mr. Gwynne, said that on the face of it the agreement was for the benefit of the shareholders.

Mr. MILLAR, Q.C., and Mr. RAWSON, for the directors, also opposed the motion.

Mr. JUSTICE DENMAN said that the case was so important that he had heard it at great length and had listened to an elaborate discussion upon it. He had heard a great many affidavits read fully on both sides, and had read some himself. The view he took of the case at the present moment was that it would be wrong and unfair if he discussed very closely the grounds upon which he now gave his decision. Most important questions were raised—one, whether there could be such a resolution as that on which the agreement in question was come to. The company was a going concern, apparently solvent, if not prosperous. As to the conduct of the chairman and directors of the company, on the affidavits, in his lordship's opinion, they might be credited with having acted with perfectly fair intentions. He abstained from expressing an opinion as to the conduct of Gwynne, whether it was proper considering his relations with the company. He left that for the decision, on full consideration, of a Judge of a Court of Equity. As to Fyfe, his conduct was open to the criticism that it was not in favour of a person in the position of plaintiff in the action, but he was acting on behalf of all the shareholders, and was supported by a considerable number. No doubt the shareholders on both sides were influenced by *ex parte* statements. There was, however, a serious question which must be decided at the trial—namely, whether the sale of the whole of the undertaking and assets of the company, under the agreement of August 13th, 1888, to the defendant Gwynne could be supported at law or on the facts. This could not be decided on this application. The question now was one of convenience, and, in his lordship's opinion, it was a greater inconvenience to leave Gwynne at the present stage of the transaction uninterfered with. It seemed more convenient that the matter should be so dealt with, that the original status of the company should remain as the normal state of things, rather than that Gwynne should be allowed to start a new state of things which might prejudice the right of the small holders of shares to have things unaltered and the business kept as a going concern. In that case his lordship thought there was nothing for it but to grant an injunction to restrain the defendants from proceeding to act upon the terms of the agreement so as to prejudice the rights of the minority until the trial of the action. It was said that a meeting of shareholders would shortly be held, but that was not before his lordship, and he hoped that that meeting would not decide anything which would lead to the result of the acts of the majority being ultimately held wrong and the company being wrecked by the state of affairs so produced. His lordship wished it to be thoroughly understood that any question of language in the claim such as "fraudulent and void" was reserved to the trial. He gave no opinion upon such questions. It appeared to him that a case for an interlocutory injunction had been made out, and the injunction must go in the terms of the notice of motion except against Scriven, who had not been served, the plaintiff giving the usual undertaking in damages, the costs to be costs in the action.

CITY NOTES, REPORTS, MEETINGS, &c.

Pilsen-Joel and General Electric Light and Power Company, Limited.

AN extraordinary general meeting of this company was held at the Cannon Street Hotel, on Monday, under the presidency of Sir Rawson W. Rawson, K.C.B.

The notice convening the meeting having been read,

The Chairman said the sole object of the meeting was to confirm the resolution which was passed at the previous meeting to proceed to voluntary liquidation. That was with the prospect of carrying out an agreement which had been entered into between the directors and Mr. Gwynne, with the sanction of a large majority of the shareholders. Since the previous meeting, however, circumstances had occurred which had entirely altered the state of affairs. Mr. Fyfe, who had taken an active part in the affairs of the company, not always nor generally with very happy results—and he (the chairman) was quite sure that it would not be with happy results on this occasion—had sought and obtained an injunction restraining the directors from carrying out the agreement. The judge did not go into particulars and did not pronounce a definite opinion upon the statements made by Mr. Fyfe, or the counter-statements presented by the directors; but he was under the impression that most important questions were raised, one being whether there could be such a resolution as that upon which the agreement in question was entered upon. He doubted whether the shareholders even were in a position to come to a resolution in a general meeting, such as the last, to sell the whole of the business of the company. Upon that ground he decided to issue an interlocutory injunction restraining them from carrying out the agreement until the question could be argued in court. This was merely a motion for a restraining injunction: it was not a motion to deal with the question at all, but merely to stop the proceedings until the question could be decided. Mr. Fyfe's grounds appeared to be three; the inability either of the directors or of the shareholders to proceed in the manner in which they did proceed, that was to vote a sale and then proceed to liquidation. There was no doubt that the liquidator, if and when appointed, would have power to carry out a sale of that description, but the judge was under the impression, although it was contested by counsel, that there was a doubt whether any such power existed in the case of the directors and shareholders. The directors were now called upon to take action under these circumstances. Their sole desire had been, was, and would be, to carry out the wishes of the majority of the shareholders, to consult the interests of all, whether in the majority or the minority, and to wind up the affairs of the company, which it seemed were not likely to be carried on in a satisfactory way under present circumstances, to the best possible advantage. They had not yet had time to consider what action should be taken. But one very important action had already been taken which, at all events, would satisfy the shareholders that neither Mr. Gwynne nor the directors had the least desire to force the contract upon any portion of the shareholders who did not consider that it was just and equitable. Mr. Gwynne had offered in the most handsome manner to cancel the agreement, with the undertaking that he would not claim an indemnity for any loss or damages which such cancelment would entail upon them. The directors had agreed to the cancellation, but whether that was a benefit to the shareholders or not was questionable. Mr. Fyfe and the directors held very opposite views as to the value of the property for selling purposes. There had been plenty of opportunity during the preceding three months of ascertaining the value of the property. The directors were satisfied that Mr. Gwynne's offer, by which he took upon himself all the liabilities and risks of the concern, was as good a one as they were likely to obtain. But, as they told Mr. Fyfe when he expressed a contrary opinion at the last committee meeting which he attended, if a better offer presented itself they would be only too happy to entertain it. No such offer had been presented, and no signs of any such offer being likely to be presented were apparent. The directors were desirous of averting from the shareholders the certain waste of their funds which would be caused by the litigation that now lay before them, and the litigation which might follow under any circumstances in connection with the opposition raised by Mr. Fyfe and those who supported him. But since the previous week, when the case was heard, they had had insufficient means and opportunity for entering upon the consideration of the best course to be adopted with the view of meeting the wishes and consulting the interests of all the shareholders, because it must be borne in mind that whilst one portion of the shareholders were unwilling to advance any more money for the carrying on of the affairs of the company, another body, holding three-fourths of the capital, were disposed to carry on the business under efficient management. Under these circumstances the directors were of opinion that it was not desirable at that meeting to take action for confirming the resolution for the liquidation of the company. They might find that such a course was the best to adopt eventually, but they would have to look into their financial position very carefully. He would remind them that when they reduced the call from 5s. to 3s. in the early part of the year, it was with the desire of calling up no more money than was requisite to meet the liabilities and to carry on the affairs until some such action as was taken at the last meeting could be taken for deciding the future of the company. But now they were almost in the month of September, and there must be some weeks' delay before they could take renewed action. No time, he could assure them, would be lost; but there was quite a possibility that it would be necessary to call up more money to carry on until a decision could be come to. That, of course, was one of the consequences of the action taken by Mr. Fyfe. He regretted it exceedingly, for he thought the litigation might have been avoided. It was not the intention of the board to move the confirmation of the resolution, and therefore the resolution would drop. The business of that meeting was therefore at an end.

Discussion ensued as to the best course to be now adopted. There were suggestions that 2s. per share should be called up and the directors instructed to proceed with the business, but there were objectors to this, and eventually it was understood that the present position of inactivity would be maintained for a further period of two months, during which the board would cast about for a definite policy, and Mr. Fyfe would pursue his endeavours to bring forward, or induce some one else to bring forward, the "better offer" of which he had spoken.

The Chatham, Rochester, and District Electric Lighting Company, Limited.

THE second ordinary meeting of this company was held at the Sun Hotel, Chatham, on Tuesday evening, the Mayor of Rochester (Mr. F. Wingent) presiding.

The Secretary (Mr. J. J. Acworth) having read the notice convening the meeting, the directors' report was read. It was as follows:—

At our first general meeting, which was held last November, we told you that 667 shares only had been taken up. This, of course, was insufficient for the purposes which your directors had in view; but we are now glad to be able to inform you that since then the whole of the shares have been applied for and allotted. The first and one of the most important questions which had to be considered after the holding of the last general meeting was that of selecting a suitable site for erecting central station. . . . . The site which was eventually selected as being the best, was a portion of the Victualling Office, Rochester, the sub-lease of which, together with a couple of offices, has been secured upon satisfactory terms. On securing the latter, the registered office of the company was removed from 22, High Street, to the Victualling Office, Rochester. Having obtained possession of the wharf, plans for the central station were prepared, and the work of making foundations and erecting buildings was set in hand with as little delay as possible. The most serious part of this business was making the necessary foundations to receive the machinery. It has, however, been done well, at a rather heavy cost. The buildings are now practically complete, the engines and boilers are fixed in place, and have been run to-day for the first time, and the dynamo electric machinery is now being erected, and will be in working order before the end of the present week. As might have been expected, considerable difficulty has been experienced in getting our mains run up and down the street, although the Corporation of Rochester and the Local Boards of Chatham and Gillingham have given us permission to cross the streets with our wires. We are, however, glad to say that the Chatham circuit is now rapidly approaching completion, and we believe that by the middle of next week it will be so; we shall then be prepared to take on customers for lighting. Taking all things into consideration, we believe we have considerable cause for encouragement since we last met. The Liverpool Electric Lighting Company has declared a dividend of 7½ per cent.; Taunton 5 per cent., and Hastings 3 per cent. In the latter case the dividend would have been much larger, had not the company been severely handicapped by circumstances which occurred years ago. From this it will be seen that electric lighting has now become a paying business, and the fact is so well recognised that wonderful activity is now evinced in every branch of electrical work; in proof of this, we can advance no better example than that afforded by the Woodhouse and Rawson Company, which declared an interim dividend of 12½ per cent., besides which a sufficient sum was carried forward to a reserve fund which would have raised the dividend to 40 per cent. As the merits of electric light are becoming more fully recognised and public confidence in the financial soundness of the same is established, it is not surprising to find that many towns are adopting the electric light, or else taking steps for so doing, such as London, Edinburgh, Dublin, Bradford, Birmingham, Liverpool, Glasgow, Southampton, Cheltenham, Leamington, Bath, Bournemouth, Poole, Weston-super-Mare, Ilfracombe, Exeter, Queenstown, Waterford, &c.

On the motion of Mr. E. Smith, seconded by Mr. S. J. Hart, it was unanimously resolved that the meeting be adjourned to November 20th.

Lancashire and Cheshire Telephonic Exchange Company, Limited.

THE report of this company states that the subscriptions and rentals (including those of the out districts) pertaining to the financial year ended June 30th, amounted to £89,797, as compared with £82,490, the amount of income carried forward as representing sums received in advance for periods extending beyond June 30th last being £40,377, against £38,276. The directors recommend a further dividend at the same rate as in February, making a complete dividend of 7 per cent. for the year, leaving a balance of £5,420, of which they propose that £3,000 be placed to the reserve fund (making a total reserve, including interest, of £8,650), and that £2,420 be carried forward.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending August 24th, 1888, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £4,367

The Brazilian Submarine Telegraph Company, Limited. The traffic receipts for the week ending August 24th amounted to £5,229.

NEW PATENTS—1888.

11897. "Electrical indicators." O. B. SHALLENBERGER, Rochester, Pennsylvania, United States, or W. P. THOMPSON. (Communicated by G. Westinghouse.) (Date applied for under Section 103 of the Patents, &c., Act, 1883, January 21, 1888.) Dated August 17. (*Complete.*)

11898. "Electrical indicators." O. B. SHALLENBERGER, Rochester, Pennsylvania, United States, or W. P. THOMPSON. (Communicated by G. Westinghouse.) (Date applied for under Section 103 of the Patents, &c., Act, 1883, January 21, 1888.) Dated August 17. (*Complete.*)

11913. "Improvements in grapnels for raising submarine cables." F. R. LUCAS. Dated August 17.

11917. "Improvements in or connected with the transmission of electric energy." J. G. LORRAIN. Dated August 17.

11925. "Improvements in electrical switches." H. W. EDLIN. Dated August 17.

11929. "Improvements in electrical indicators." G. BINSWANGER. Dated August 18.

11937. "Improvements in apparatus for driving dynamos and similar machines for electrical purposes." F. C. LYNDE. Dated August 18.

11963. "Improvements in or connected with electric rail or tramway systems." M. H. SMITH. Dated August 18.

11965. "Improvements in anti-induction electric apparatus." J. CERPAUX, P. BORRE, and L. MAERTENS. Dated August 18.

12054. "Improved means for diminishing the injurious effects of induction currents in telegraphic and telephonic circuits." E. LIEBERT and S. A. ROSENTHAL. Dated August 21.

12063. "Improvements in or relating to electrical type-writers." A. J. BOULT. (Communicated by J. F. McLaughlin, United States.) Dated July 21. (*Complete.*)

12064. "Improvements in or relating to electrical type-writers." A. J. BOULT. (Communicated by J. F. McLaughlin, United States.) Dated August 21. (*Complete.*)

12065. "Improvements in or relating to electrical type-writers." A. J. BOULT. (Communicated by J. F. McLaughlin, United States.) Dated August 21. (*Complete.*)

12066. "Improvements in or relating to electrical type-writers." A. J. BOULT. (Communicated by J. F. McLaughlin, United States.) Dated August 21. (*Complete.*)

12127. "Improvements in and relating to electric motors." J. FEAVERYEAR. Dated August 22.

12129. "Improvements in automatic electric signalling for railways." J. L. E. DANIEL. Dated August 22.

12149. "An improved electric battery." J. HARGREAVES and J. SEWELL. Dated August 23.

12155. "A new or improved application of electricity to the manufacture of soap." R. SCOTT and C. R. HELD. Dated August 23.

12157. "Improvements in portable electric lamps with combinations." J. S. ROSS. Dated August 23.

12158. "Improvements in working railways by electricity." C. E. SPAGNOLETTI. Dated August 23.

12163. "Improved cell or containing vessel for electric batteries." H. G. C. SERRIN. Dated August 23.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1888.

155. "Improvements in or relating to electrical turnstiles." A. J. BOULT. (A communication from O. Ehrling, of Plagwitz.) Dated January 4. 8d. Has for its object to obviate the employment of a booking clerk or attendant in concert-halls, museums, theatres, and the like by permitting the visitor to pass after the introduction of a coin of a certain value in the apparatus, which is moreover provided with a recording device. The claims are 3 in number.

506. "Improvements in the construction of suspension fittings for incandescent electric lamps." C. M. DORMAN and R. A. SMITH. Dated January 12. 6d. The inventors form the reflecting shade of one solid piece of china, porcelain or earthenware, having a central hole for the passage of the conducting wires, this hole being of such a size that the shade can be firmly suspended by forming a knot in the conducting wires, or by knotting a piece of string or other suitable material round the conducting wires. They use a lampholder having a projection or projections on its metallic base, and attach it to the shade by means of screws, bolts, or rivets passing through a hole or holes in these projections and through a hole or holes in the shade. The claims are 3 in number.

623. "Improvements in thermo-electric elements and piles." R. J. GULCHER and J. PINTSCH. Dated January 14. 8d. Consists chiefly in making the thermo-electric bars of which the elements or piles are composed, not, as heretofore, of solid bodies but of hollow bodies, and so arranged that only their smallest base surfaces are used for heating, while all the other surfaces are used for cooling the elements. The claims are 7 in number.

633. "Improvements in dynamo-electric machines." C. COERPER. Dated January 14. 8d. In carrying the invention into practice the inventor mounts upon the shaft or axle to be driven the two elements of the dynamo, that is to say, the armature and the field magnet in such a manner that the field magnet is rigidly connected with the shaft, whilst the armature can turn freely upon the said shaft. The said armature can, however, be retarded in its motion or brought to rest by a brake device. If a current is passed to the dynamo, the armature and the field magnet element will tend to turn in opposite directions; and if, as in this case, the field magnet is fixed to the shaft, the armature will turn alone. In proportion, however, as the rotation of the same is retarded by the application of a brake, the field magnet which is fixed to the shaft will tend to set the shaft in motion. This motion will be accelerated the stronger the brake is applied to the armature until with the stoppage, caused by the application of the brake, of the said armature the axle receives from the field magnet fixed upon it its maximum velocity corresponding to the current introduced. The claims are 4 in number.

734. "Improvements in galvanic batteries." J. NOAD. Dated January 17. 8d. Has especial reference to the application to the battery of means for causing an accumulation within the vessel of the gases generated by the action of the battery while it remains in action, in such a manner as that the pressure thereby occasioned shall be effective in displacing the electrolyte from submerging the exciting salts, and consequently stopping the continued generating action of the battery until the latter is again required to be used, when the battery may be immediately restarted.

750. "Improvements in and relating to electric railways and to vehicles for use thereon." H. H. LAKE. (Communicated from abroad by D. Gustavus Weems, of America.) Dated January 17. 11d. Relates to an improved electric railway system for transporting mail, express, and other packages at a rapid speed over a line either above, on, or below the ground, using electricity as a motive power, and having the motor located in a travelling car or locomotive, and having attached thereto a series or train of cars, the said train being supplied with means for automatically controlling, starting, and stopping itself; and this invention consists in the improved system and in certain novel constructions and combinations of devices described. The claims are 8 in number.

1078. "Improvements in switches for making and breaking electrical circuits." S. BERGMANN and J. T. DEMPSTER. Dated January 24. 8d. Claims:—1. In an electrical switch the combination of the handle, the peculiar cam turned by the handle, the pivotted spring-connected arms bearing on the cam, and the moving contact piece, such parts being arranged and connected so as to operate, substantially as described. 2. In an electrical switch, the combination with the base, and the moving contact piece of stationary contact springs, posts from which such springs project, which posts extend through the base, and are made hollow to admit the passing of circuit wires from beneath the base up through said posts axially, and set screws in said posts above the base to bind the circuit wires, substantially as described.

2179. "Improvements in incandescent electric lamps." M. WHEELER. Dated February 13. 6d. Consists in the combination of a suitable holder, frame, or cup, which is filled with an amorphous mass of zirconia, with a number of pairs of carbons, which extend into the frame or cup, and around the points of which the zirconia is packed, each pair of carbons being connected to opposite poles of a suitable battery, whereby the currents of electricity are made to flow in opposite directions, meeting and passing each other at a common centre. The claims are 4 in number.

2250. "Improvements in printing telegraphs." J. H. LINVILLE. Dated February 14. 3s. Relates especially to that class of printing telegraphs which operate automatically as transmitters or as receivers by electrical pulsations sent from any instrument organised as a transmitter, or from a central station pulsator over a conductor connected with one or more instruments organised as receivers, when the printing by the transmitters and receivers is controlled by any instrument in the line operating as a transmitter. The organisation of the instruments and circuits is such as to adapt them to a complete system of communication between business offices either in direct connection by private wires or connected through a central station. The instruments operate with single line conductors and local batteries, or with two conductors dispensing with local batteries, with or without central station pulsators and without the employment of alternating currents of reverse polarity. The invention further relates to improvements in apparatus described in letters patent No. 11,181, dated August 16th, 1887, for presenting the paper in page form, from a continuous roll to the type-wheel. The claims are 114 (!!!) in number.

3097. "An improvement in holding the plates of secondary voltaic batteries." B. M. DRAKE and J. M. GORHAM. Dated February 29. 6d. Claim:—The described method of holding the plates of secondary voltaic batteries by providing them at their edges with lugs or projections entering holes formed in the sides of frames which are made of insulating material and which enclose a set of the plates.

3483. "Improvements in electrical switches." F. T. SCHMIDT. Dated March 7. 6d. Claims:—1. An electrical switch in which are combined a disc with metallic surface plates for making and breaking contact by the operation of the disc in the same or opposite directions, the same being constructed and operated substantially in the manner shown and described. 2. An electrical switch in which a disc having metallic surface plates thereon, combined with a spring, substantially in the manner and for the purpose described. 3. An electrical switch having a disc with metallic surface plates thereon, reduced at one or both ends combined with flanges also reduced at one or both ends and constructed substantially in the manner and for the purpose as shown and described.

CORRESPONDENCE.

Dry Elements.

On looking over the paper by H. von Billing, which you publish in your issue of the 17th inst., I noticed what I take to be a slight error, either in the test or in the written description. In the diagram given the circuit is always closed through the nickel silver wire of 1 S.U. resistance. Later on we are told that the resistance of the cell is equal to that inserted by the rheostat, W. Clearly the total resistance of the circuit outside the battery must be that in W 1 S.U. A few months ago I had occasion to test several cells in my laboratory for much the same purpose as H. von Billing, but found great difficulty in ascertaining the internal resistance of those at all liable to polarise when discharging. Even the short time required to plug or unplug the rheostat or turn a handle allows the resistance wanted to alter, and prevents anything like an accurate result. There was a cell described by an American, Roberts, which was nearly dry, and gave very good results. Permanganate of potash entered into the mixture; I forget what else. A small cell, formed of a bit of arc light carbon as positive plate, rang an electric bell easily; and the battery could be inverted without any of the contents escaping, as they formed an apparently dry solid mass.

C. H. Yeaman.

London, N., *August 23rd*, 1888.

Curative Magnetism.

A gentleman has handed to us copies of your paper bearing date August 17th and 24th, and we have carefully read your articles on Parkes's Patent Compound Magnets. We confess we are unable to determine the object of these articles; they are certainly not attacks on us, and, as certainly, not written in a commendatory spirit.

Beyond affording an opportunity for a little not ill-natured chaff, we can find no particular point in what you have written. You do not touch upon the all-important question,—Is magnetism of use in certain human ailments? Nor yet upon the secondary one: Do Parkes's compound magnets afford a convenient and satisfactory means of applying this power? You might with equal propriety purchase a watch, take it to pieces, and tell your readers that it is composed of certain little wheels, pinions, springs, &c. (which could be made for such and such a sum), the whole enclosed in a case, "supposed to tell the time," and selling for a given sum. If your readers had no notion what a watch really was, they would be left in profound obscurity both as to its nature and your meaning. Is magnetism of use in certain human ailments? It hardly comes within your province, Sir, to give any answer to this question. Your *ex officio* statement would not carry more weight than that of any other educated and intelligent person, without special knowledge of the subject.

No one (least of all ourselves) will deny the weight of your authority on such a point as to whether a given number of discs of copper and zinc, acted upon by skin secretions, can generate a current of electricity sufficient to overcome the resistance of the skin.

We have not been trading upon other people's money, and we had to satisfy ourselves that very wonderful and beneficial results were constantly attained by wearing magnets on the person. We did satisfy ourselves, and few days pass by without additional proof that we were right. It is no light matter to enter into a business such as ours: it requires several thousand pounds of capital, and it demands something more than "faith and flannel" if it is to succeed. Be assured, Sir, that we have ample evidence of our good faith when there is a specific call for its production.

Trusting to your sense of fair play to insert this letter.

Pp. **The Medical Magnet Co.**
G. G.

August 27th, 1888.

Galvanic Belt Quackery.

Dr. Andrew Wilson has admitted his connection with Harness. He states in his letter, which appeared in your issue of the 24th August, that he became a director of Harness's Ammoniaphone Company years after the notice on Mr. Lant Carpenter's report of the "medical battery belt" was written. After this admission we can proceed with the case. In the volume of *Health* for 1883, on pages 277, 299, 309, 324, 341, 372, and 388, will be found Mr. Lant Carpenter's articles on bogus electrical appliances. Did not Dr. Andrew Wilson obtain one of the marvellous electropathic belts from the establishment of the "great humanitarian," and send it to Mr. Carpenter to be tested? Did not Mr. Carpenter condemn the said belt as a bogus appliance, and did not Dr. Wilson refuse the Medical Battery Company's advertisement after Mr. Carpenter's report?

Yet Dr. Wilson admits that in spite of the eye opener he must have received in 1883, he became in 1886 a director of the company promoted for the puffing and the sale of the Ammoniaphone (Harness's patent) sold at Harness's electropathic belt shop. It is much to be regretted that Dr. Wilson ever allowed his name to be mixed up with that of the "eminent electrician," and President of the B. A. of Med. Electricians.

J. Jerritt, *A.S.T.E. & E.*

August 27th, 1888.

Dynamo Variations.

I agree with many of the remarks in your article on "Dynamo Variations," but as regards the Oerlikon dynamos, you are mistaken in supposing that I have changed either my views or my practice. If you will refer to a letter of mine, dated 21st February, 1888, you will see that I said embedded wires could scarcely be used for high tension machines, such as the 625 volt 270 ampère dynamo in question. As evidence that I still use holes you will see next week, in a contemporary, an illustration of a 6,000 ampère 16-20 volt machine, designed for the manufacture of aluminium, in which they are employed with advantage.

C. E. L. Brown.

Maschinenfabrik Oerlikon,
Oerlikon bei Zurich, *August 27th*, 1888.

TO MICROPHONE.—We believe that the address of the Anglo-Portuguese Telephone Company is 53, New Broad Street, London, E.C.